

حمل الآن

مجاناً وحصرياً

المراجعة رقم (1)

اختبار شهر مارس

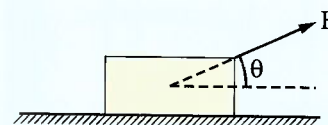




Choose the correct answer (1 : 20) :

- 1 Which of the following statements is correct regarding the mechanical energy of a ball thrown upwards in a gravitational field?
- (a) It decreases during ascent and increases during descent.
 - (b) It increases during ascent and decreases during descent.
 - (c) It equals zero at the highest point the ball reaches.
 - (d) It remains constant throughout the ball's motion in the air.

- 2 In the opposite figure, a force (F) acts on a stationary object placed on a smooth surface, causing it to move a displacement (d). Students suggested some changes to reduce the work done on the object to move it from rest through the same displacement (d), which are:

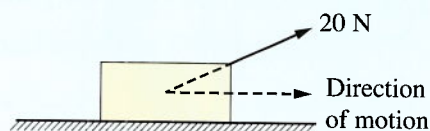


- (I) Reducing the magnitude of the applied force.
- (II) Reducing the angle between the directions of the force and displacement.
- (III) Increasing the magnitude of the applied force.
- (IV) Increasing the angle between the directions of the force and displacement.

Which of these changes, if each is done separately, leads to reducing the work done on the object?

- (a) (III), (IV).
- (b) (II), (III).
- (c) (I), (IV).
- (d) (I), (II).

- 3 In the shown figure, if the object moves a displacement of 2 m on a frictionless surface as a result of being acted upon by a force of magnitude 20 N, then the work done on it by this force is



- (a) greater than 40 J
- (b) less than 40 J
- (c) equal to 40 J
- (d) equal to zero

- 4 If the weight of an object on the Earth's surface is 6 times its weight on the Moon's surface, then the ratio between its kinetic energy on the Earth's surface and its kinetic energy on the Moon's surface when it moves at the same speed is equal to

- (a) $\frac{1}{6}$
- (b) $\frac{1}{1}$
- (c) $\frac{6}{1}$
- (d) $\frac{36}{1}$

5 A person pushes a box on a horizontal surface, and the following forces act on the box:

- (I) The person's pushing force.
- (II) The friction force.
- (III) The gravitational force (weight).
- (IV) The surface reaction force (normal force).

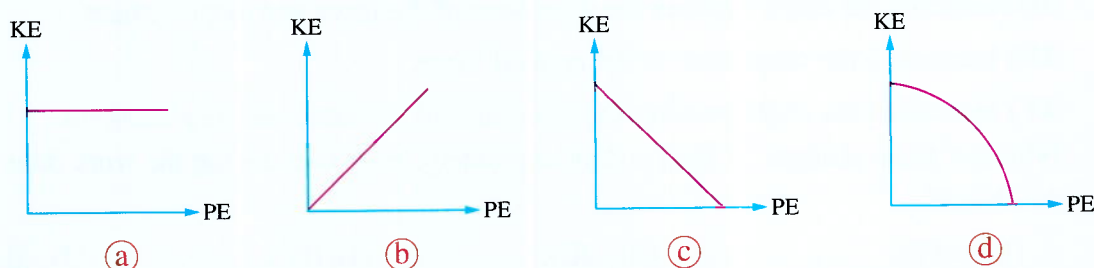
Which pair of these forces does no work on the box as it moves a displacement (d)?

- (a) Forces (I), (II).
- (b) Forces (III), (IV).
- (c) Forces (I), (IV).
- (d) Forces (II), (III).

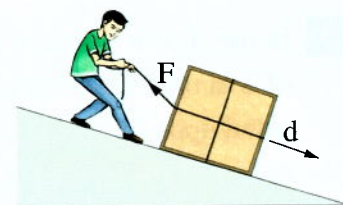
6 If the kinetic energy of a ball decreased to one-third, this means its speed

- (a) decreased to $\frac{1}{3}$
- (b) decreased to $\frac{1}{9}$
- (c) decreased to $\frac{1}{\sqrt{3}}$
- (d) increased to 3 times

7 A body is projected vertically upwards from the Earth's surface. Which of the following graphs represents the relationship between its kinetic energy (KE) and its potential energy (PE) during its ascent until it reaches its maximum height?



8 In the opposite figure, a person tries to pull a box with a force (F) up an inclined plane using a rope. However, the box slides downwards, so the work done on the box by:



	The tension force in the rope	The gravitational force
(a)	Positive	Positive
(b)	Positive	Negative
(c)	Negative	Positive
(d)	Negative	Negative

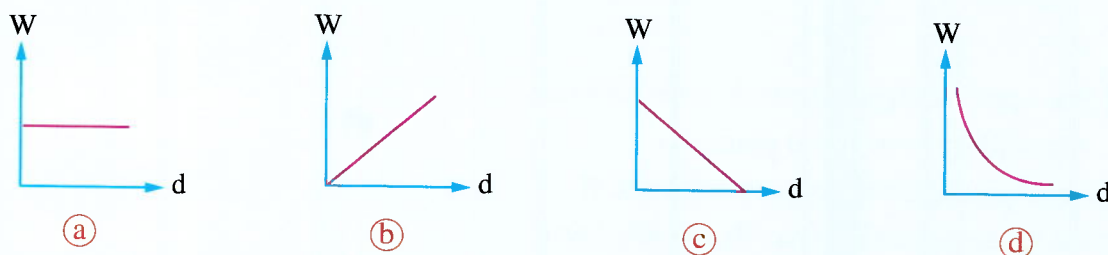
- 9 An object has a potential energy of 200 J when it is at a height (h) from the ground surface. If it is left to fall freely from this height, its kinetic energy becomes 50 J when it becomes at a height from the ground surface equal to

(a) $\frac{h}{4}$ (b) $\frac{h}{2}$ (c) $\frac{3h}{4}$ (d) $\frac{4h}{5}$

- 10 Two bodies, A and B, have the same mass. They are projected vertically upwards from the Earth's surface with speeds of v and $2v$, respectively. So, the ratio between the mechanical energies acquired by each of them $\left(\frac{E_A}{E_B}\right)$ is

(a) $\frac{4}{1}$ (b) $\frac{1}{1}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

- 11 An object placed on a surface is affected by a constant force (F), so it moves a displacement (d) in the same direction of the force. So, which of the following graphs represents the relationship between the work done (W) on the object by the force (F) and the magnitude of its displacement (d)?



- 12 An object of mass 19 kg falls freely from a height of 60 m. Its kinetic energy when it is halfway down at the midpoint of the distance between the point from which it gets fallen and the ground surface is equal to ($g = 10 \text{ m/s}^2$)

(a) 2850 J (b) 5700 J (c) 8550 J (d) 11400 J

- 13 A car of mass 1000 kg moves down at a constant speed along a slope 100 m long and inclined at an angle of 30° to the horizontal. The magnitude of the change in its potential energy from the beginning of the slope to its end is ($g = 9.8 \text{ m/s}^2$)

(a) $4.9 \times 10^5 \text{ J}$ (b) $5.8 \times 10^5 \text{ J}$ (c) $6.7 \times 10^5 \text{ J}$ (d) $8.6 \times 10^5 \text{ J}$

- 14 An object of mass 12 kg falls freely, if its mechanical energy at the midpoint of the distance between its starting point and the ground surface is 150 J, so the height from which the object falls equals ($g = 10 \text{ m/s}^2$)

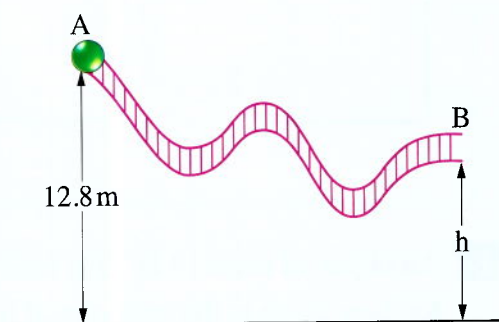
(a) 1.25 m (b) 2.5 m (c) 5 m (d) 12.5 m

- 15** A person throws a ball from a height of 10 m above the ground surface vertically downwards with a velocity of 14 m/s, so the velocity of the ball at the ground surface equals ($g = 9.8 \text{ m/s}^2$)
- (a) 9.9 m/s (b) 19.8 m/s (c) 29.7 m/s (d) 39.5 m/s

- 16** A stone is thrown vertically upwards with a specific speed from the Earth's surface, reaching a height of 12 m. If the same stone is thrown with the same velocity on the Moon's surface, the height it reaches will equal
(Given: acceleration due to gravity on the Moon = $\frac{1}{6}$ acceleration due to gravity on Earth)
- (a) 2 m (b) 12 m (c) 28 m (d) 72 m

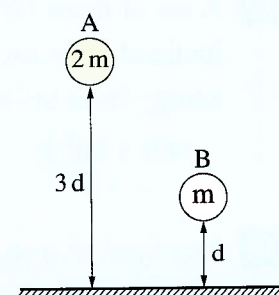
- 17** An object is projected vertically upwards from the roof of a building at 20 m/s at a height of 15 m above the ground surface, so its kinetic energy equals its potential energy relative to the ground surface at a height of ($g = 10 \text{ m/s}^2$)
- (a) 7.5 m (b) 17.5 m (c) 20 m (d) 35 m

- 18** The opposite figure shows a sphere of mass 4 kg sliding from rest at point (A) on a frictionless smooth curved track. If the sphere speed at point (B) is 8 m/s, then the height of point (B) from the Earth's surface is equal to ($g = 10 \text{ m/s}^2$)
- (a) 6.8 m (b) 7.2 m
(c) 8.8 m (d) 9.6 m



- 19** Two objects (A) and (B) fall freely towards the ground from the two positions shown in the opposite figure, so the ratio between the kinetic energies of the two objects $\left(\frac{KE_A}{KE_B}\right)$ at the moment they collide with the ground equals

- (a) $\frac{1}{3}$ (b) $\frac{3}{1}$
(c) $\frac{1}{6}$ (d) $\frac{6}{1}$

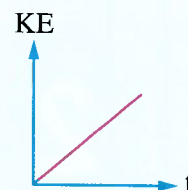


- 20** A worker does work of 36 J against a friction force of 20 N in pushing a vacuum cleaner on the ground at a constant speed for 4.5 s, so the speed with which the vacuum cleaner moves is

(a) 0.4 m/s (b) 0.3 m/s (c) 0.2 m/s (d) 0.1 m/s

Answer the following questions (21 : 24) :

- 21** The opposite graph represents the change in kinetic energy (KE) of an object of mass m versus time (t). Is the object moving with constant speed or a variable speed?



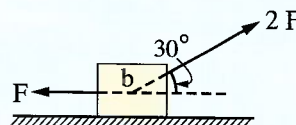
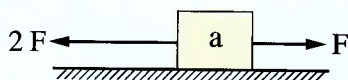
- 22** An object of mass m is suspended by a rope. When the rope is cut, the object falls freely from rest from a height h above the ground. **Prove that** the speed of the object (v) upon impact with the ground surface is given by the relation: $v = \sqrt{2 gh}$

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- 23** When a car goes down a slope, its speed increases even if the driver does not press the gas pedal. **Explain this** in light of your study of energy transformations.

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- 24** In the following two figures, two objects a and b are placed on a smooth horizontal surface. If two forces F and $2F$ act on each of them causing both of them to move a horizontal displacement of magnitude (d). **Which** of the two bodies has more work done on it by the net force acting on each of them?



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Questions ?

Chapter

2

Lesson 1

Oscillatory Motion

Answered

First

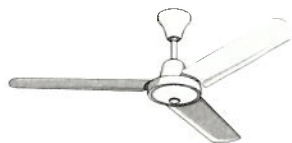
Multiple Choice Questions

Questions signed by * are answered in detail.

Interactive test



- 1 Which of the following figures represents a body moving with an oscillatory motion?



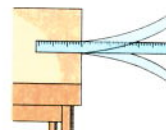
a



b



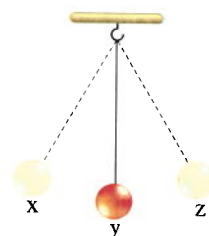
c



d

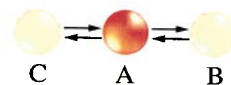
- 2 In the opposite figure, the pendulum makes a complete oscillation when it moves from

- a $x \rightarrow y$
 b $x \rightarrow y \rightarrow z$
 c $x \rightarrow y \rightarrow z \rightarrow y$
 d $x \rightarrow y \rightarrow z \rightarrow y \rightarrow x$



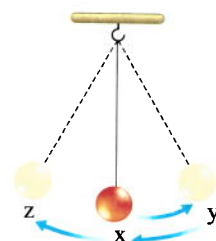
- 3 In the opposite figure, a body moves in an oscillatory motion, so the distance which is moved by the body during a complete oscillation equals

- a double the distance AB
 b double the distance BC
 c half the distance AC
 d four times the distance BC

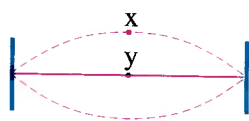


- 4 The opposite figure shows a simple pendulum vibrating with an amplitude A. If its bob has moved from position x to position y then to position z, the magnitude of displacement of the pendulum bob equals

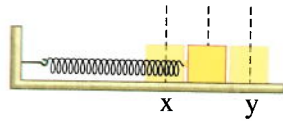
- a A
 b 2 A
 c 3 A
 d zero



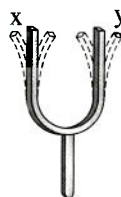
- 5 In which of the following figures is the distance between the two positions x, y representing the amplitude of vibration?



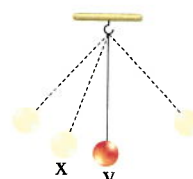
a



b



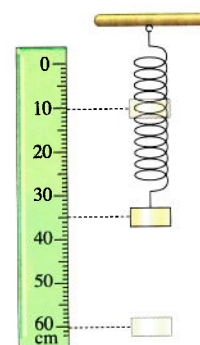
c



d

- 6 In the opposite figure, a body is suspended to a vertical spring coil besides a ruler where it vibrates between the marks 10 cm, 60 cm, so the distance covered by the body during two complete vibrations equals

(a) 25 cm
(b) 50 cm
(c) 100 cm
(d) 200 cm



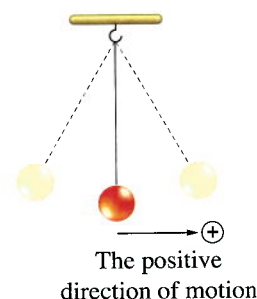
- 7 The opposite figure shows a vibrating string with a periodic time T , so the time taken by the string to reach the maximum displacement from its equilibrium position is

(a) $\frac{T}{4}$ (b) $\frac{T}{3}$ (c) $\frac{T}{2}$ (d) T



- 8 In the opposite figure, the periodic time of an oscillating simple pendulum is the time taken by the pendulum bob to pass for two successive times through a point in its path when this point is

(a) at the equilibrium position
(b) at the maximum displacement away from the equilibrium position
(c) between the equilibrium position and the maximum displacement on the right side
(d) between the equilibrium position and the maximum displacement on the left side



- 9 In the opposite figure, a tone with a frequency 247 Hz is produced due to the vibration of a guitar string, then the periodic time of the vibrating string equals

(a) 2×10^{-3} s (b) 3×10^{-3} s
(c) 4×10^{-3} s (d) 5×10^{-3} s

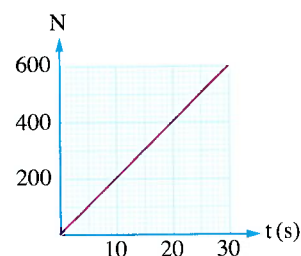


- 10 If a vibrating object takes 0.1 s to complete one oscillation, the number of complete oscillations made by the object during 100 s equals

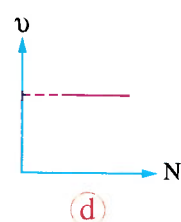
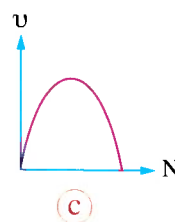
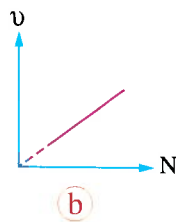
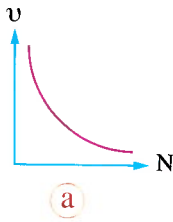
(a) 10 (b) 100 (c) 1000 (d) 10000

- 11 The opposite graph represents the relation between the number of oscillations (N) produced by an oscillating source and the time (t), so the frequency of the source equals

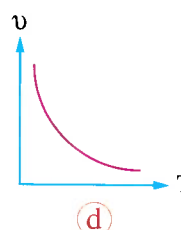
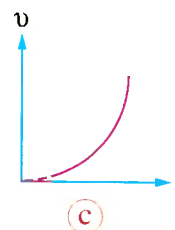
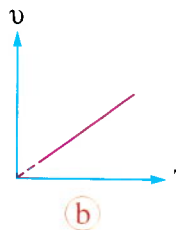
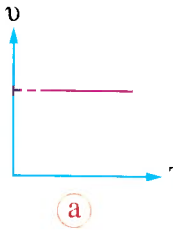
(a) 10 Hz (b) 20 Hz
(c) 40 Hz (d) 800 Hz



- 12 Which of the following graphs represents the relation between the frequency (ν) of a tuning fork and the number of complete oscillations (N) made by the fork?



- 13 Which of the following graphs represents the relation between the frequency (ν) and the periodic time (T) of a body making a simple harmonic motion?



- 14 Two pendulums (x, y) are oscillating, the ratio between their periodic times ($\frac{T_x}{T_y}$) is $\frac{1}{4}$, then the ratio between their frequencies ($\frac{\nu_x}{\nu_y}$) equals

(a) $\frac{1}{4}$

(b) $\frac{1}{2}$

(c) $\frac{4}{1}$

(d) $\frac{2}{1}$

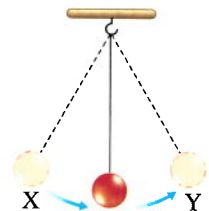
- 15 In the opposite figure, if the pendulum takes 1 s to move from point X to point Y, its frequency equals

(a) 0.5 Hz

(b) 5 Hz

(c) 10 Hz

(d) 50 Hz



- 16 * A vibrating body, the quotient of its periodic time over its frequency equals $\frac{1}{625} \text{ s}^2$, so the number of oscillations made by the body during 25 s is oscillations.

(a) 25

(b) 125

(c) 425

(d) 625

- 17 * In the opposite figure, a flexible oscillating rod takes time of 0.01 s to move from point a to point b, then:

(i) Its periodic time equals

(a) 0.02 s

(b) 0.04 s

(c) 0.06 s

(d) 0.08 s

(ii) The amplitude of its oscillation is

(a) 3 cm

(b) 6 cm

(c) 9 cm

(d) 12 cm

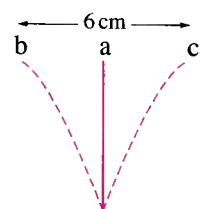
(iii) The value of the average speed of the rod during its motion from point b to point c equals

(a) 600 cm/s

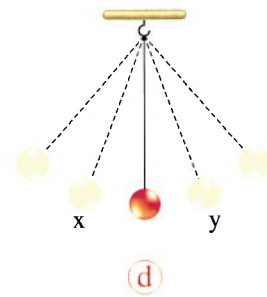
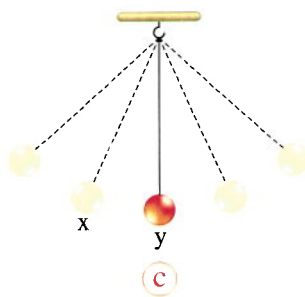
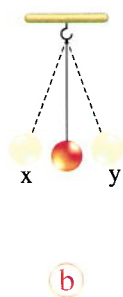
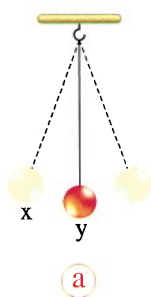
(b) 300 cm/s

(c) 150 cm/s

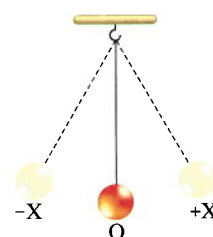
(d) 75 cm/s



- 18 Each of the following figures represents a simple pendulum in which the bob takes time t to move from point x to point y , which of the following figures represents a simple pendulum that has the lowest frequency?



- 19 In the opposite figure, a simple pendulum makes a simple harmonic motion of periodic time (T). So, starting from point $(+X)$, the point at which the bob of the pendulum becomes after a time interval of:



(i) $2T$ is

- (a) point $(-X)$ (b) point $(+X)$
(c) point (O) (d) between the two points $(+X), (O)$

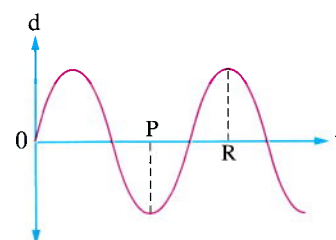
(ii) $3.5T$ is

- (a) point $(-X)$ (b) point $(+X)$
(c) point (O) (d) between the two points $(-X), (O)$

(iii) $5.25T$ is

- (a) point $(+X)$ (b) point (O)
(c) between the two points $(-X), (O)$ (d) between the two points $(+X), (O)$

- 20 The opposite graph represents the relation between the displacement (d) of a vibrating body and the time (t), so the time difference between the two points P, R is



- (a) half the periodic time (b) double the periodic time
(c) the periodic time (d) quarter the periodic time

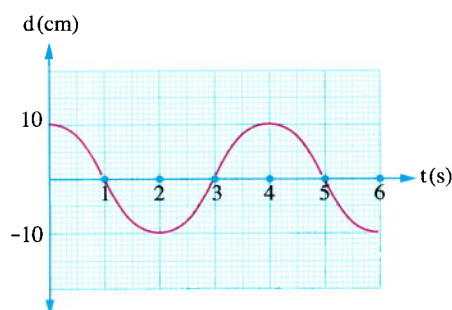
- 21 The opposite graph represents the variation of the displacement (d) of a body which makes a simple harmonic oscillation with time (t), then:

(i) The amplitude of its oscillation is equal to

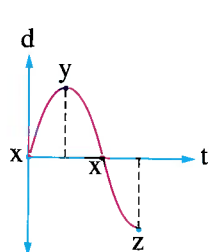
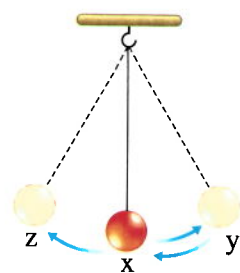
- (a) 5 cm (b) 6 cm
(c) 10 cm (d) 20 cm

(ii) The periodic time of its motion equals

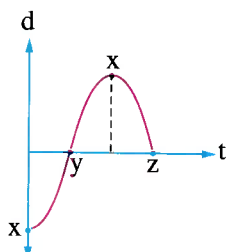
- (a) 2 s (b) 3 s (c) 4 s (d) 6 s



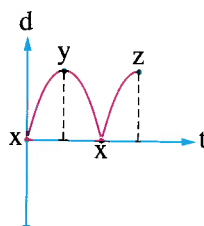
- 22 * Which of the following graphs represents the relation between the displacement (d) from position x for the bob of the pendulum shown in the opposite figure and the time (t) when the pendulum moves from position x to y then z ?



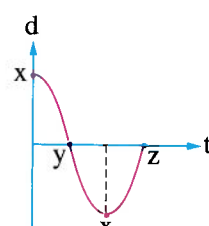
(a)



(b)

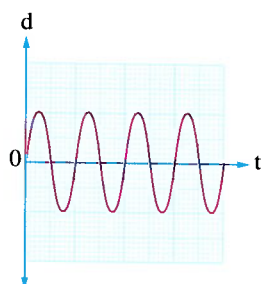
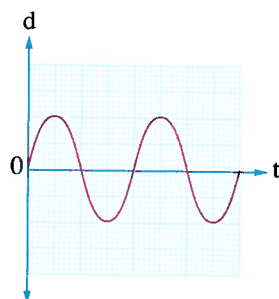


(c)

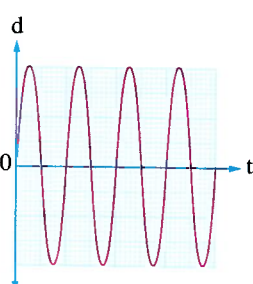


(d)

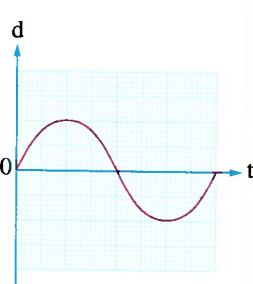
- 23 * A simple pendulum vibrates with frequency ν and amplitude A , the opposite graph represents the relation between the displacement (d) for the bob of the pendulum and the time (t), if the length of the pendulum string and the work done on the bob are modified to increase both the frequency and the amplitude of vibration to the double, which of the following graphs represents the relation between the displacement (d) and the time (t) for the motion of the pendulum in this case?



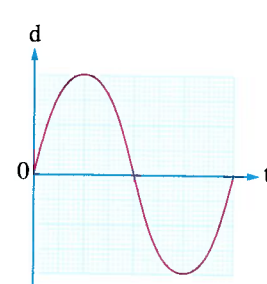
(a)



(b)



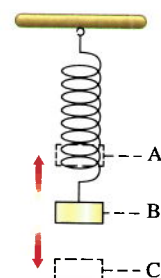
(c)



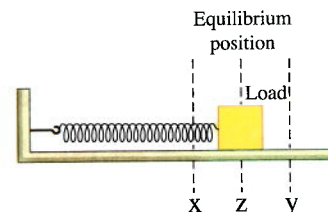
(d)

- 24 In the opposite figure, a body suspended to a vertical spring is pulled downwards from point B to point C then left to move a simple harmonic motion. The mechanical energy of this body when the air resistance is neglected will be

- (a) a maximum value at point (A) (b) a maximum value at point (B)
(c) a minimum value at point (B) (d) constant at all points

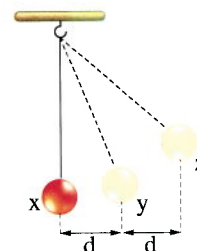


- 25 The opposite figure shows a load placed on a smooth horizontal surface connected to a spring coil while moving a simple harmonic motion, if the load passes by position z with a velocity of 0.5 m/s towards the left at a certain instant, what will be the position and the velocity of the load after it completes one and a half oscillation from that instant?



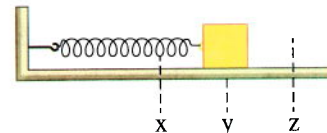
	Position	Frequency
(a)	z	0
(b)	y	0.5 m/s towards the right
(c)	x	0
(d)	z	0.5 m/s towards the right

- 26 * In the opposite figure, if the time taken by the pendulum to move from position x to y is t_1 and the time taken by the pendulum to move from y to z is t_2 , so



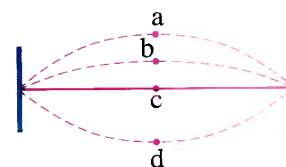
- (a) $t_1 = t_2$ (b) $t_1 > t_2$
(c) $t_1 < t_2$ (d) the answer is indeterminable

- 27 The opposite figure represents a body attached to a spring and oscillates between the two positions x and z, then the position at which the body has:



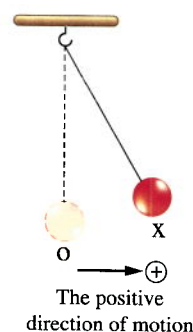
	The highest speed	The lowest potential energy
(a)	y	y
(b)	z	y
(c)	y	z
(d)	z	z

- 28 The opposite figure shows a horizontal vibrating string, which of the following ratios of potential energy is less than one?



- (a) $\frac{(PE)_a}{(PE)_c}$ (b) $\frac{(PE)_d}{(PE)_a}$
(c) $\frac{(PE)_b}{(PE)_d}$ (d) $\frac{(PE)_a}{(PE)_b}$

- 29 * The opposite figure shows a simple pendulum that moves in a simple harmonic motion of periodic time 2 s, so the time taken from the moment at which the bob is left to move from position x until it has:



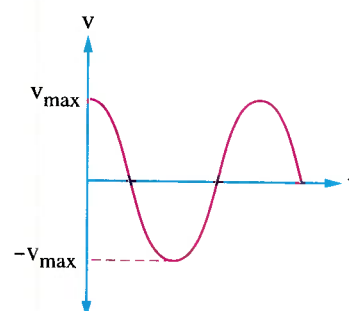
- (i) The maximum displacement in the negative direction for the first time equals

(a) 0.5 s (b) 1 s
(c) 1.5 s (d) 2 s

- (ii) The maximum speed for the first time equals

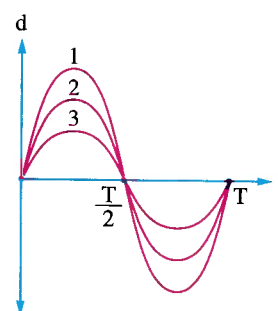
(a) 0.5 s (b) 1 s (c) 1.5 s (d) 2 s

- 30 The opposite graph represents the relation between the velocity (v) of the bob of a simple pendulum and the time (t) when it is observed starting from



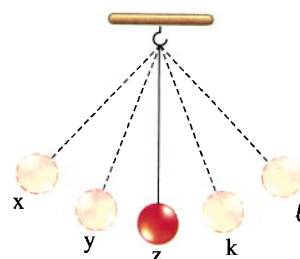
- (a) its equilibrium position
(b) the position of maximum displacement
(c) the position at which the bob has the maximum possible potential energy
(d) the midpoint between its equilibrium position and its maximum displacement

- 31 * Three identical bodies make simple harmonic motions, the opposite graph represents the relation between the displacement (d) and the time (t) for each of them, so the correct arrangement of these bodies according to the mechanical energy of the body is



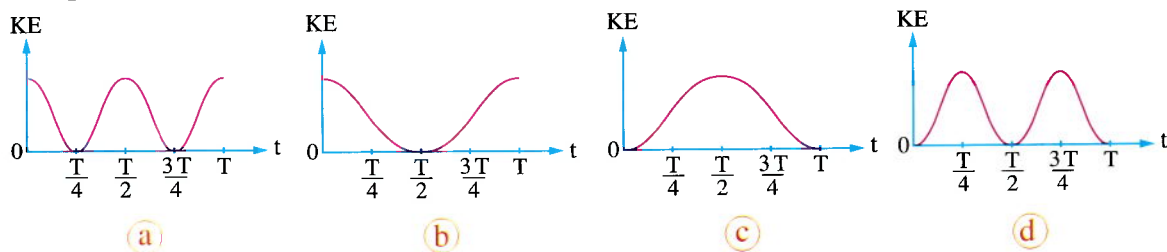
- (a) $1 > 2 > 3$ (b) $3 > 2 > 1$
(c) $1 > 3 > 2$ (d) $1 = 2 = 3$

- 32 The opposite figure shows the motion of a simple pendulum and the distances xy , yz , zk , kl are equal. If the pendulum takes time t to move from x to y , the periodic time is



- (a) equal to $8t$ (b) less than $8t$
(c) greater than $8t$ (d) indeterminable

- 33 * A simple pendulum started a simple harmonic motion from the farthest position away from its equilibrium position at $t = 0$. If the periodic time of the pendulum is T , which of the following graphs represents the relation between the kinetic energy (KE) of the pendulum bob and the time (t)?



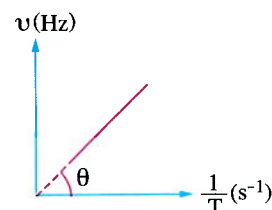
Second Essay Questions

- 1 What happens to the periodic time of a vibrating object when its frequency gets tripled? Explain your answer.

- 2 Describe the transformations of potential and kinetic energies for the swing shown in the opposite figure through a complete oscillation starting from the equilibrium position.



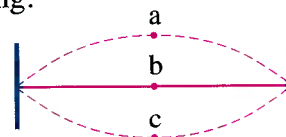
- 3 The opposite graph represents the relation between the frequency (ν) of an oscillatory motion and the reciprocal of its periodic time ($\frac{1}{T}$) when the two coordinates are drawn with the same scale, what is the value of angle θ ?



- 4 The opposite figure shows the motion of a horizontal vibrating string.

(a) At which points is:

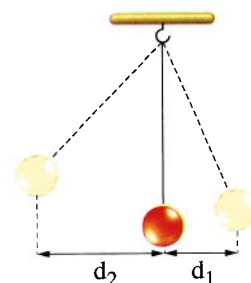
- (1) the speed of the string maximum?
- (2) the elastic potential energy of the string maximum?



(b) Find the ratio between the taken time for the string motion from b to c and the taken time for its motion from b to a.

- 5 The opposite figure represents two attempts to move the bob in a simple harmonic motion, in the first attempt when it is displaced for a distance d_1 and then left to vibrate and in the second attempt when it is displaced for a distance d_2 and then left to vibrate.

What happens to each of the amplitude, the maximum potential energy and the mechanical energy of the pendulum bob in the second attempt compared to the first attempt?



Choose the correct answer:

- 1 Figure (1) shows a pendulum whose equilibrium position is at y oscillating between the two positions x, z and figure (2) shows graphically the relation between the displacement (d) of the pendulum bob from position x and the time (t), then:

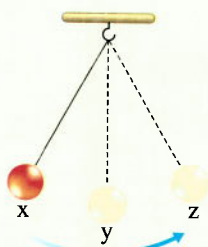


Figure (1)

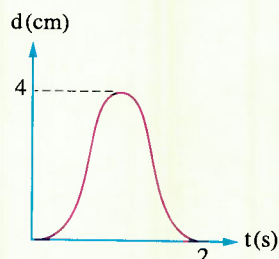
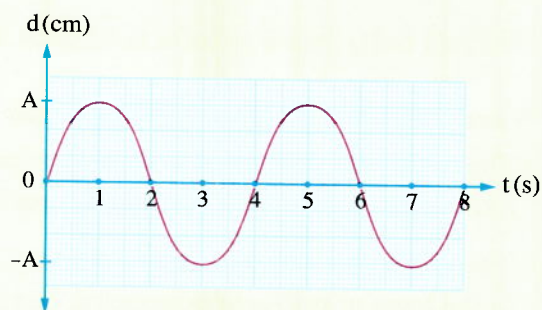


Figure (2)

- (i) The amplitude of the pendulum bob equals
- (a) 1 cm (b) 2 cm (c) 4 cm (d) 8 cm
- (ii) The frequency of the pendulum equals
- (a) 0.25 Hz (b) 0.5 Hz (c) 2 Hz (d) 4 Hz

Answer the following question:

- 2 A body suspended by a string is pushed to the right to swing left and right about its original equilibrium position, the opposite graph represents the relation between the displacement (d) starting from the moment of pushing the body and time (t) through 8 s, if we consider that the direction of its motion to the right is the positive direction, **then at which moment or moments during this period the body will be:**



- (a) Moving towards the right with a maximum speed?
- (b) Moving towards the left with a maximum speed?
- (c) Static instantaneously?

Questions ?

Chapter 2 | Lesson 2

Answered

Wave Motion

First

Multiple Choice Questions

Questions signed by * are answered in detail.

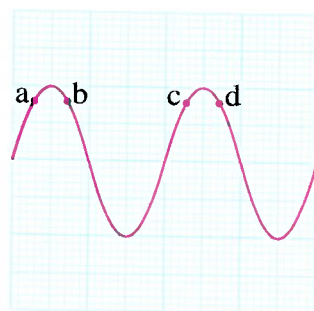
Interactive
test



- 1 The waves propagating in a medium can transfer
 - a the particles of the medium in the direction of propagation
 - b the particles of the medium perpendicular to the direction of propagation
 - c the energy in the direction of propagation
 - d the energy perpendicular to the direction of propagation

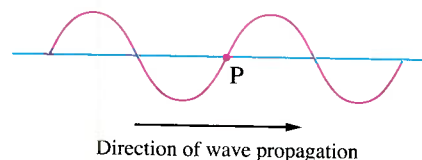
- 2 The opposite figure represents a wave, which of the points a, b, c and d have the same phase?

- a a, b, c
- b a, b
- c b, c
- d b, d



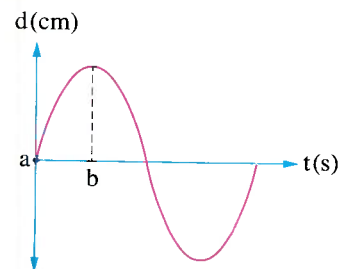
- 3 * The opposite figure represents a transverse mechanical wave propagating in a medium from left to right, so in which direction does the particle P move at the shown instant?

- a Rightward
- b Leftward
- c Upward
- d Downward

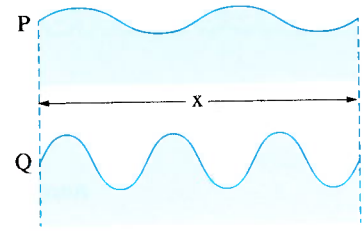


- 4 A transverse wave of frequency 50 Hz propagates in a certain medium and the opposite graph represents the relation between the displacement (d) of one of the medium particles and the time (t), then the time interval ab is

- a $\frac{2}{25}$ s
- b $\frac{1}{25}$ s
- c $\frac{1}{50}$ s
- d $\frac{1}{200}$ s

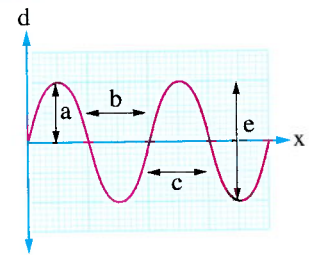


- 5 The opposite two figures represent two water waves P and Q propagating for a distance x with the same speed, which of these two waves has the largest amplitude and which has the highest frequency?



	The wave of the largest amplitude	The wave of the highest frequency
a	P	P
b	P	Q
c	Q	P
d	Q	Q

- 6 * The opposite graph represents the relation between the displacement (d) of the particles of a medium in which a transverse wave propagates with frequency ν , amplitude A and the distance (x) travelled by the wave, if:

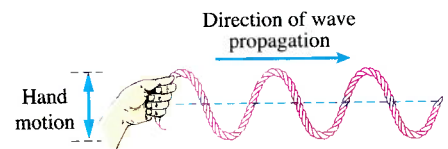


- (i) The frequency of the wave is doubled at constant amplitude, distance
- a a increases to the double b b increases to the double
c c decreases to its half d e decreases to its half
- (ii) The amplitude of the wave is doubled at constant frequency, distance
- a a decreases to its half b b decreases to its half
c c increases to the double d e increases to the double

- 7 If the wavelength of a transverse wave is λ , the distance between the first crest and the crest of order n equals
- a $n\lambda$ b $(n+1)\lambda$ c $(n-1)\lambda$ d $(n-\frac{1}{2})\lambda$

- 8 In the opposite wave, if the distance between the first crest and the third trough is 100 cm, the wavelength for this wave equals

- a 10 cm b 20 cm
c 40 cm d 70 cm



- 9 The following figures show four sources of waves, which of them produces longitudinal waves through its surrounding medium?



Light bulb

a



Horn speaker

b



TV remote control

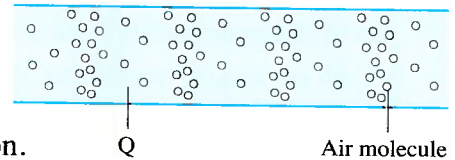
c



A hand causes a disturbance on water surface

d

- 10 The opposite figure represents a model of sound wave propagating through air inside a tube opened from both ends, how to describe region Q?

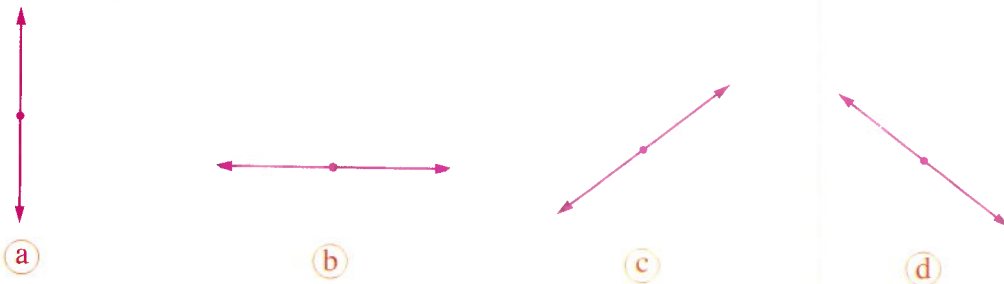


- (a) A region of high density which is called compression.
- (b) A region of low density which is called compression.
- (c) A region of high density which is called rarefaction.
- (d) A region of low density which is called rarefaction.

- 11 If the distance between two successive points having the same phase for a wave equals 50 cm, then the wavelength of this wave equals

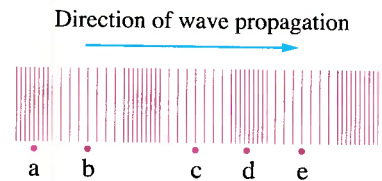
- (a) 0.125 m
- (b) 0.25 m
- (c) 0.5 m
- (d) 1 m

- 12 A longitudinal wave propagates in a medium to the right (→). Which of the following figures correctly represents the direction of vibration of the particles of this medium?



- 13 The opposite figure represents a longitudinal wave, then the ratio between the two distances $\left(\frac{X_{ac}}{X_{de}}\right)$ is

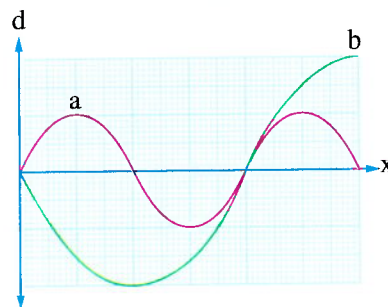
- (a) $\frac{4}{1}$
- (b) $\frac{2}{1}$
- (c) $\frac{3}{2}$
- (d) $\frac{3}{1}$



- 14 Two sound waves (A) and (B) propagate in the same medium, if the frequency of wave (A) is twice as the frequency of wave (B), then the relation between

	Their periodic time	Their wavelength
(a)	$T_A = T_B$	$\lambda_A = \lambda_B$
(b)	$T_A = T_B$	$\lambda_A = \frac{1}{2} \lambda_B$
(c)	$T_A = \frac{1}{2} T_B$	$\lambda_A = \lambda_B$
(d)	$T_A = \frac{1}{2} T_B$	$\lambda_A = \frac{1}{2} \lambda_B$

- 15 The opposite graph represents the relation between the displacement (d) of the particles of a medium in which two sound waves (a) and (b) propagate and the distance (x) travelled by the two waves, so:



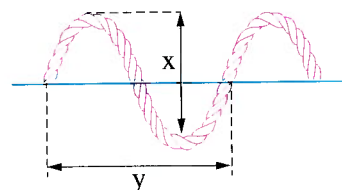
- (i) The ratio between the frequencies of the two waves ($\frac{v_a}{v_b}$) is

a $\frac{1}{1}$ b $\frac{2}{1}$ c $\frac{1}{2}$ d $\frac{1}{4}$

- (ii) The ratio between the amplitudes of the two waves ($\frac{A_a}{A_b}$) is

a $\frac{1}{1}$ b $\frac{2}{1}$ c $\frac{1}{2}$ d $\frac{4}{1}$

- 16 The opposite figure represents a wave propagating in a rope, then this wave is

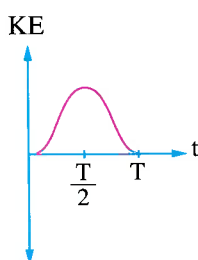
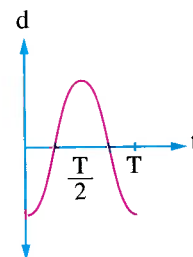


- a a longitudinal wave of wavelength x
 b a longitudinal wave of wavelength y
 c a transverse wave of wavelength x
 d a transverse wave of wavelength y

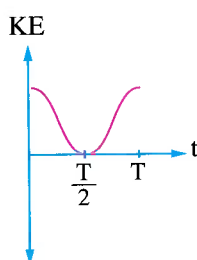
- 17 What is the characteristic that describes all the longitudinal waves and does not describe all the transverse waves?

- a They can be travelling waves.
 b They require a medium in order to propagate.
 c They transfer energy in the direction of their propagation.
 d Their speed of propagation differs from medium to another.

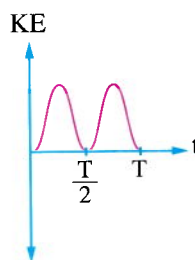
- 18 * A wave propagates in a string and the opposite graph represents the relation between the displacement (d) of one of the string parts about its equilibrium position and the time (t), which of the following graphs represents the relation between the kinetic energy (KE) of this part and the time (t)?



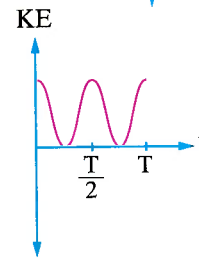
a



b



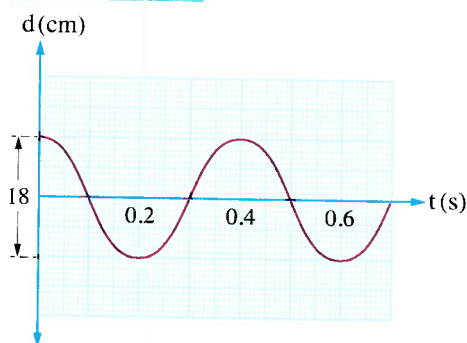
c



d

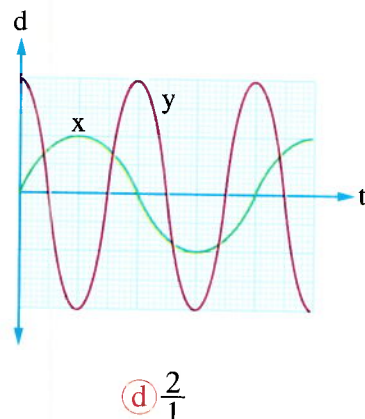
- 19 When a pulse is made in a rope, the speed of the pulse along the rope
 (a) remains constant (b) decreases
 (c) increases (d) increases then decreases
- 20 A transverse wave propagates through a thin thread at speed 300 m/s. If the distance between two successive crests is 3 m, so the wave frequency equals
 (a) 30 Hz (b) 100 Hz (c) 300 Hz (d) 900 Hz
- 21 A wave of frequency 100 Hz is generated in a string, so if it has a wavelength of 0.5 m, then:
 (i) The wave speed through the string equals
 (a) 25 m/s (b) 50 m/s (c) 100 m/s (d) 200 m/s
 (ii) If the frequency increases to 300 Hz at constant speed, the wavelength becomes
 (a) 0.03 m (b) 0.17 m (c) 3 m (d) 6 m
- 22 If the frequency of the school bell ringtone is 102 Hz and the number of waves between it and the flagpole is 12 waves, so given that the speed of sound in air is 340 m/s, so the distance from the flagpole to the bell is equal to
 (a) 3.3 m (b) 19.8 m (c) 40 m (d) 60 m

- 23 The opposite graph represents the relation between the vertical displacement of one of the medium particles (d) and the time (t) for a wave travelling through this medium, then:



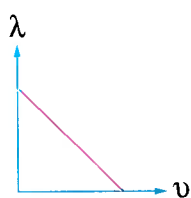
- (i) The amplitude of that wave is
 (a) 9 cm (b) 17.5 cm
 (c) 18 cm (d) 35 cm
- (ii) The frequency of the wave is
 (a) 1.7 Hz (b) 2.5 Hz (c) 3.3 Hz (d) 5 Hz
- (iii) The periodic time of the wave propagation is
 (a) 0.4 s (b) 0.6 s (c) 0.7 s (d) 0.8 s

- 24 The opposite graph shows the relation between the displacement (d) and the time (t) for two sound waves x and y propagating in the same medium, so the ratio of:

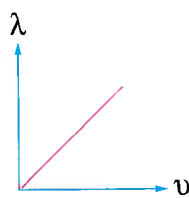


- (i) The frequencies of the two waves $\left(\frac{v_x}{v_y}\right)$ equals
 (a) $\frac{1}{4}$ (b) $\frac{1}{2}$
 (c) $\frac{1}{1}$ (d) $\frac{2}{1}$
- (ii) The speeds of the two waves $\left(\frac{v_x}{v_y}\right)$ equals
 (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{1}$ (d) $\frac{2}{1}$

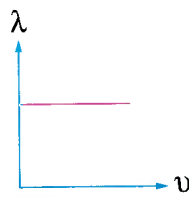
- 25 Which of the following graphs represents the relation between the wavelength (λ) for multiple sound waves propagating in air and the frequency (ν) for each of these waves?



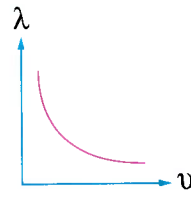
(a)



(b)

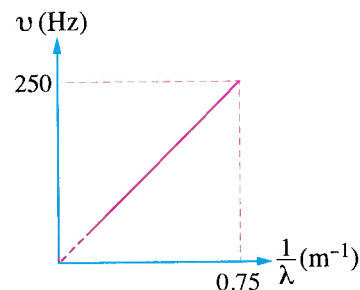


(c)



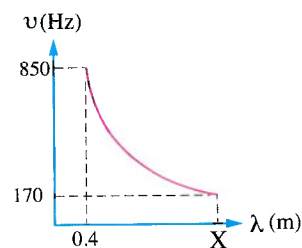
(d)

- 26 A sound source produces tones (waves) with different frequencies propagating in air, the opposite graph represents the relation between the frequency (ν) and the reciprocal of wavelength ($\frac{1}{\lambda}$) for these waves, then the speed of the sound wave propagation through the air almost equals



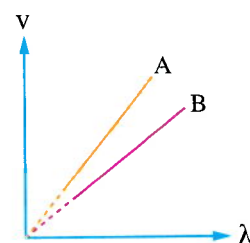
- (a) 50 m/s (b) 187 m/s
(c) 254 m/s (d) 333 m/s

- 27 The opposite graph represents the relation between the frequency (ν) and the wavelength (λ) for the waves produced from several tuning forks that vibrate in air, so the value of X is



- (a) 0.8 m (b) 1.2 m
(c) 1.6 m (d) 2 m

- 28 The opposite graph shows the relation between the speed (v) and the wavelength (λ) for two different waves of the same type (A and B) when they propagate through many different media, so



- (a) $v_A > v_B$ (b) $v_A < v_B$
(c) $T_A = T_B$ (d) $T_A > T_B$

- 29 Two laser rays, one of them is red and the other is green, propagate in space, so the two rays certainly have the same

- (a) intensity (b) frequency (c) speed (d) wavelength

- 30 An electromagnetic wave of wavelength λ and frequency ν propagates in air with speed c , so which of the following choices represents the wavelength and the speed of another electromagnetic wave that has frequency $\frac{\nu}{2}$ and propagates in air?

	The wavelength	The speed
a	$\frac{\lambda}{2}$	$\frac{c}{2}$
b	$\frac{\lambda}{2}$	c
c	2λ	c
d	2λ	$2c$

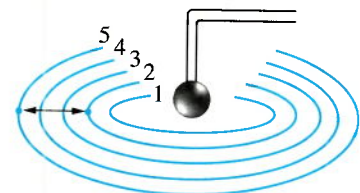
- 31 * The human ear can hear frequencies between 20 Hz and 2×10^4 Hz, then the shortest and the longest wavelengths that can be heard by the human ear respectively are,

(Given that: The speed of sound in air = 340 m/s)

- a 0.06 m, 59 m b 6800 m, 6.8×10^6 m
c 0.017 m, 17 m d 0.005 m, 0.05 m
- 32 A sound source produces 60 vibrations within 1.5 s and the produced wave propagates in air with a speed of 340 m/s, then the distance between the centers of a compression and a successive rarefaction equals

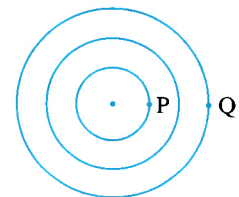
- a 2.8 m b 4.25 m c 5.67 m d 8.5 m

- 33 * The opposite figure represents a source vibrating with a frequency of 4 Hz producing waves that propagate on the surface of water with a speed of 0.4 m/s as concentric circular ripples around the source, given that each circle represents a crest, so the distance between the second and the fifth crest equals



- a 0.1 m b 0.2 m c 0.3 m d 0.5 m

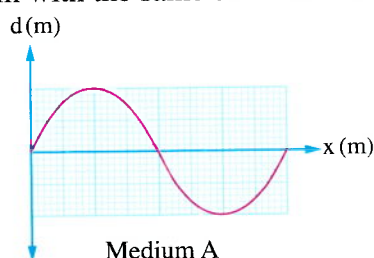
- 34 * A small stone has fallen into a pond of still water, circular waves are formed on the water surface as shown in the opposite figure where each circle represents a crest of a wave, if the speed of the water waves is v and its wavelength is λ , the time taken by the disturbance to move from point P to point Q equals



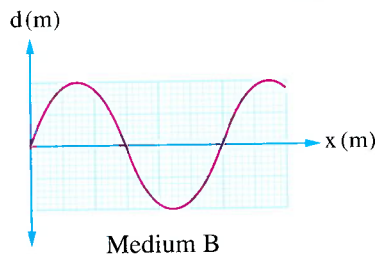
- a $\frac{\lambda}{2v}$ b $\frac{\lambda}{v}$ c $\frac{3\lambda}{2v}$ d $\frac{2\lambda}{v}$

- 35 If the speed of water waves that pass by a certain point is 1.5 m/s and there are 30 waves pass by this point in 1 s, the number of waves in a distance of 60 m equals
- (a) 3 waves (b) 40 waves (c) 400 waves (d) 1200 waves

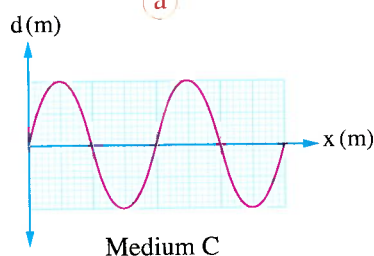
- 36 * A wave travels between four different media A, B, C and D and the following graphs represent the relation between the vertical displacement (d) of the particles of each medium at a certain moment and the propagation distance (x) of the wave through each medium with the same scale. In which medium does the wave have the highest speed?



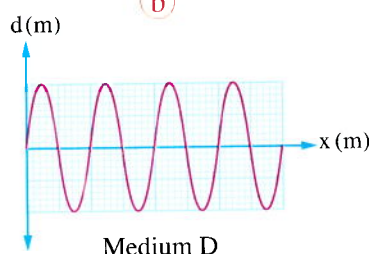
(a)



(b)

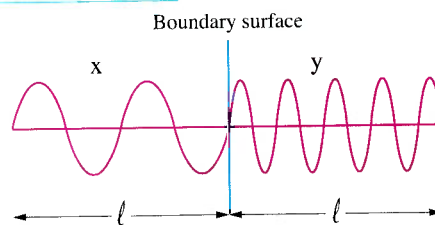


(c)



(d)

- 37 * The opposite figure represents a wave which is travelling through medium x, then it moves to another medium y, so the ratio between the speed of the wave in medium x to its speed in medium y ($\frac{v_x}{v_y}$) is



(a) $\frac{9}{4}$

(b) $\frac{4}{9}$

(c) $\frac{2}{1}$

(d) $\frac{1}{1}$

- 38 If the terminal of a spring is being moved to make a transverse wave of wavelength 30 cm and its periodic time 0.1 s, then the terminal of the spring is being moved to make a longitudinal wave of periodic time 0.2 s and its speed is three times the speed of the transverse wave, so the wavelength of the longitudinal wave equals

(a) 45 cm

(b) 90 cm

(c) 135 cm

(d) 180 cm

- 39 If the distance between the second crest and the seventh crest in a transverse wave is 20 m and the time interval between passing the first crest and the fifth crest by a certain point in the path of the wave is 0.1 s, then:

(i) The wavelength of the wave equals

(a) 0.2 m

(b) 0.25 m

(c) 4 m

(d) 5 m

(ii) The speed of the wave propagation equals

(a) 250 m/s

(b) 160 m/s

(c) 10 m/s

(d) 0.1 m/s

- 40  * A stone was thrown into a lake, so 50 waves were formed after 5 seconds from the collision of the stone with the water surface, when the radius of the outer circle was 2 m, then:

(i) The wavelength of the wave is

- (a) 0.04 m (b) 0.08 m (c) 25 m (d) 100 m

(ii) The frequency of the wave is

- (a) 0.1 Hz (b) 10 Hz (c) 25 Hz (d) 250 Hz

(iii) The speed of the wave propagation is

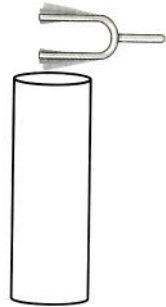
- (a) 2.5 m/s (b) 2 m/s (c) 1 m/s (d) 0.4 m/s

- 41 A train was at rest in a railway station when it blew a whistle of frequency 300 Hz. A man at distance 0.99 km from the train heard the sound 3 s later after being produced, then the wavelength of the sound equals

- (a) 1.1 m (b) 0.91 m (c) 0.11 m (d) 0.09 m

- 42 * The opposite figure represents a tuning fork of frequency 200 Hz that was struck and put at one of the openings of a tube of length 8 m that is opened at both ends. If the beginning of the first wave reached the end of the tube when the sixth wave was about to enter the tube, the speed of sound in air is

- (a) 360 m/s (b) 340 m/s
(c) 330 m/s (d) 320 m/s



- 43 Two sound waves a and b whose frequencies are 512 Hz and 256 Hz respectively, propagate in a certain medium; so:

(i) The ratio between their speeds $\left(\frac{v_a}{v_b}\right)$ is

- (a) $\frac{2}{1}$ (b) $\frac{1}{1}$ (c) $\frac{1}{2}$ (d) $\frac{3}{1}$

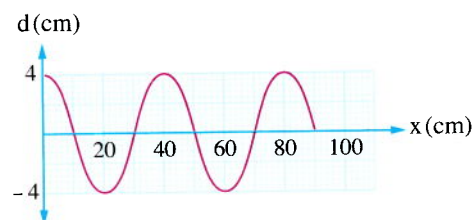
(ii)  The ratio between their wavelengths $\left(\frac{\lambda_a}{\lambda_b}\right)$ is

- (a) $\frac{2}{1}$ (b) $\frac{1}{2}$ (c) $\frac{3}{1}$ (d) $\frac{1}{3}$

- 44 A wave of frequency 100 Hz and wavelength 20 cm propagates in a medium, if it transfers to another medium where its speed becomes 30 m/s, then in the second medium

	The frequency (Hz)	The wavelength (cm)
(a)	100	20
(b)	100	30
(c)	150	20
(d)	150	30

- 45 * Electromagnetic waves were transmitted from a wireless transmission station towards a satellite with a speed of 3×10^8 m/s and after 0.03 s, the station received the reflected waves from the satellite, hence the distance between the transmission station and the satellite equals
- (a) 4.5×10^6 m (b) 9×10^6 m (c) 2×10^{10} m (d) 1×10^{10} m
- 46 A transverse wave of frequency 16 Hz propagates in a given medium with a speed 3.2 m/s, if the vertical distance between a crest and its successive trough equals the horizontal distance in the direction of wave propagation between them, its amplitude equals
- (a) 0.5 m (b) 0.2 m (c) 0.1 m (d) 0.05 m
- 47 * A stationary ship A sends two sound signals to another stationary ship B, one of the two signals in air and the other in water. If the signal that is transmitted in air reaches ship B after that transmitted in water by 6 s, then the distance between the two ships is (Given that: The speed of sound in air is 340 m/s and in water is 1480 m/s)
- (a) 1.33 km (b) 2.65 km (c) 3.98 km (d) 5.34 km
- 48 If the distance between the centers of a compression and its successive rarefaction in the path of a longitudinal wave is 0.15 m and the time taken between their pass by a certain point in the path of the wave is $\frac{1}{150}$ s, the speed of the wave propagation equals
- (a) 22.5 m/s (b) 45 m/s (c) 90 m/s (d) 100 m/s
- 49 * The opposite graph represents the relation between the displacement of the medium particles (d) through which a wave propagates at a given instant and the horizontal propagation distance (x) of this wave, if one of the medium particles takes time (t) to have a displacement of 4 cm away from its equilibrium position, the wave moves through the time (t) a distance of
- (a) 10 cm (b) 20 cm (c) 40 cm (d) 80 cm



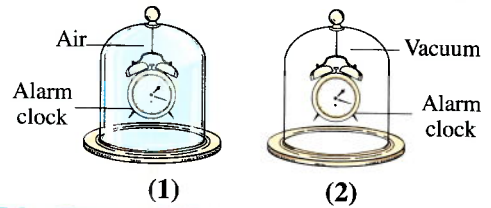
Second Essay Questions

- 1 The opposite figure shows a pulse moving through a spring, **study the figure and answer the following questions:**



- (a) **What** is the type of the produced mechanical wave in the spring?
- (b) **What** is the direction of the vibration of the medium particles with respect to the direction of wave propagation?

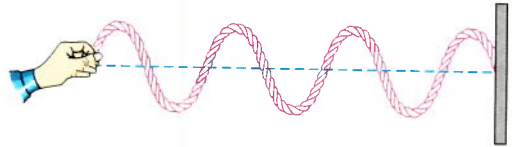
- 2 In the opposite figure, two glass jars contain two alarm clocks, one of them contains air and the other is evacuated from air, **which** of the two alarms can be heard? **And why?**



- 3 **Explain the following statements:**

- (1) Electromagnetic waves don't need a medium through which they can propagate.
- (2) We see the light of the Sun and don't hear the sound of the explosions on its surface.
- (3) Astronauts use wireless devices to communicate on Moon.

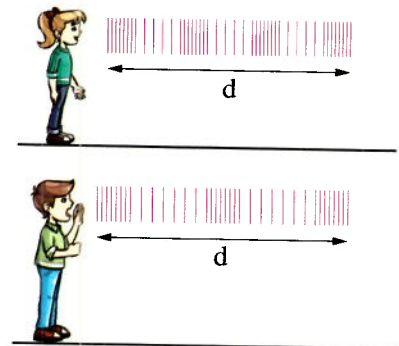
- 4 If a rope is fixed to the wall and its other terminal is being moved up and down so that a wave is produced in the rope as shown in the opposite figure, so if you move your hand faster without changing the vertical displacement of your hand's motion or the tension force in the rope, **what happens for each of the following:**



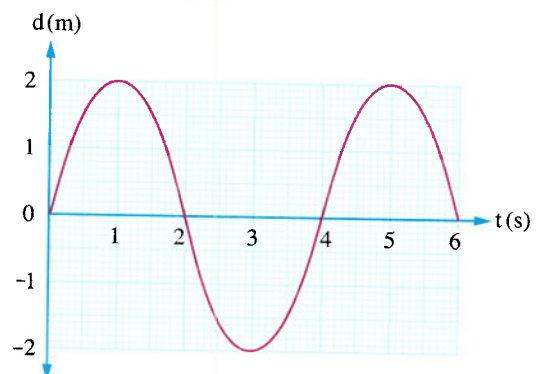
- (a) The amplitude?
- (b) The wavelength?
- (c) The frequency?
- (d) The periodic time?
- (e) The wave speed?

- 5 The opposite figure shows two sound waves propagate in the air which are produced by a man and a girl:

- (a) **Which** of the two sound waves is travelling faster? **And why?**
- (b) **Which** of the sound waves has higher frequency? **And why?**



- 6 The opposite graph shows the relation between the vertical displacement (d) and the time (t) for a segment of a rope pulled horizontally along which a wave propagates due to the vibration of one of its ends up and down:



- (a) **What** is the type of the formed wave in the rope?
- (b) **Calculate** the frequency of the wave.
- (c) **Plot** using the same scale the relation between the displacement (d) and the time (t) for a wave that has double the frequency and half the amplitude of this wave.

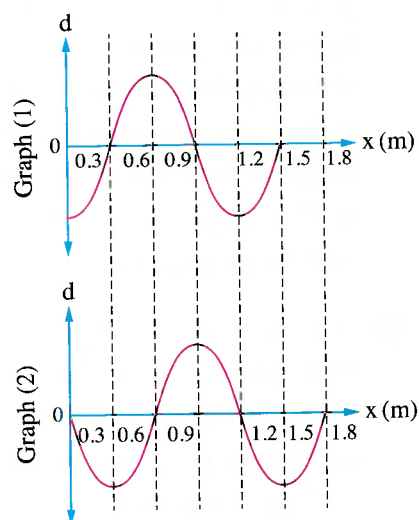
Choose the correct answer:

- 1 Two tones have frequencies 680 Hz and 425 Hz in air, if the wavelength of one of them is greater than the wavelength of the other wave by 30 cm, the speed of sound in air equals

(a) 320 m/s (b) 330 m/s (c) 340 m/s (d) 544 m/s

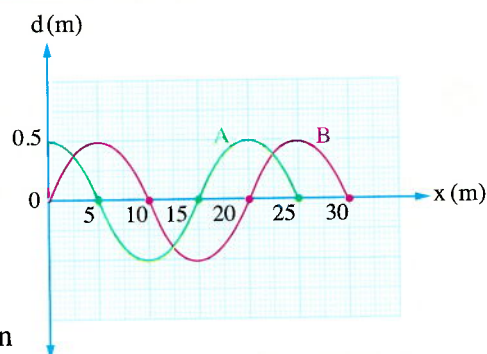
- 2 Graph (2) represents the position of a travelling wave in a string after 0.025 s from its position that is represented in graph (1), then the frequency of the wave equals

(a) 7.5 Hz
(b) 10 Hz
(c) 15 Hz
(d) 30 Hz



- 3 The opposite graph illustrates two curves A and B, curve A represents the relation between the vertical displacement (d) of the medium particles and the horizontal distance (x) covered by the wave at a certain instant and curve B represents the same relation for the same wave after passing 2 s, then the speed of wave propagation equals

(a) 1.25 m/s (b) 2.5 m/s (c) 5 m/s (d) 40 m/s



Questions ?

Chapter

3

Lesson 1

Answered

Properties of Light

- Propagation of Light
- Reflection of Light
- Refraction of Light

Interactive test



First

Multiple Choice Questions

Questions signed by * are answered in detail.

► Electromagnetic spectrum - Light reflection

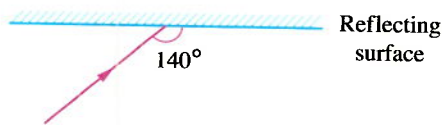
- 1 If the opposite table shows some selected wavelengths from the electromagnetic spectrum in air, so

- (a) $M < Z < Y$ (b) $Y < Z < M$
(c) $Y < Z = M$ (d) $Y = Z > M$

	Wavelength
Visible light	M
Gamma rays	Y
X-rays	Z

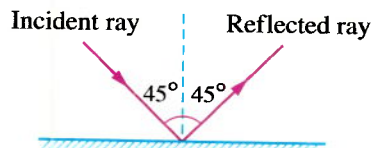
- 2 The opposite figure shows a light ray being incident on a reflecting surface, so its angle of reflection equals

- (a) 40° (b) 50° (c) 60° (d) 90°



- 3 In the opposite figure, a light ray is incident with speed v on the surface of a mirror and gets reflected from it, so the speed of the ray after its reflection becomes

- (a) $\frac{1}{\sqrt{2}} v$ (b) v
(c) $\sqrt{2} v$ (d) $2 v$



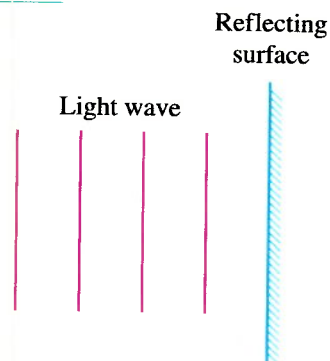
- 4 The opposite figure shows a light wave being incident on a reflecting surface, so this wave:

(i) gets reflected by an angle of

- (a) 0° (b) 45°
(c) 90° (d) 180°

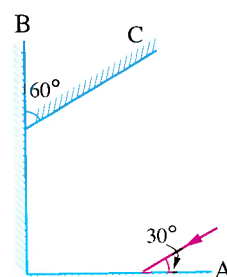
(ii) gets deviated from its path by an angle of

- (a) 0° (b) 45°
(c) 90° (d) 180°

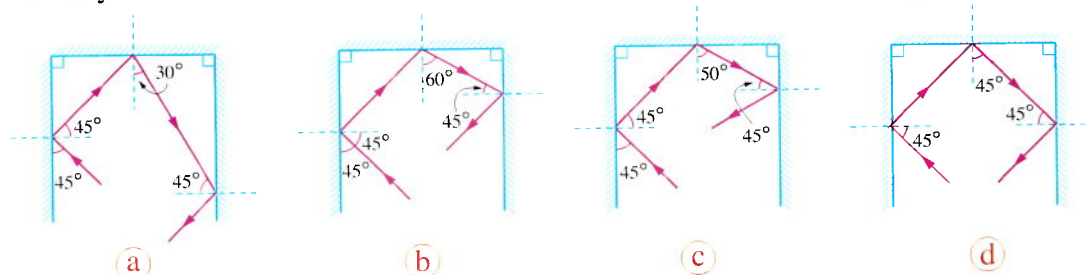
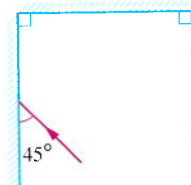


- 5 A light ray is incident on mirror (A) as in the opposite figure, so the ray reflects

- (a) from mirror C at an angle of 30°
- (b) from mirror C at an angle of 45°
- (c) from mirror C at an angle of 60°
- (d) parallel to mirror C

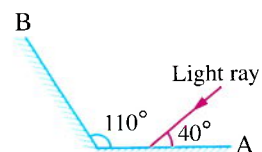


- 6 The opposite figure represents three plane mirrors forming three sides of a square. Which of the following choices shows the correct path of the incident light ray as it gets reflected by the three mirrors?



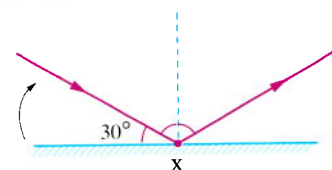
- 7 In the opposite figure, the angle of reflection of the light ray from mirror B equals

- (a) 20°
- (b) 40°
- (c) 60°
- (d) 70°



- 8 If the mirror gets rotated about point x in the direction shown in the figure by an angle of 10° , the angle between the incident ray and the reflected ray becomes

- (a) 140°
- (b) 135°
- (c) 125°
- (d) 115°



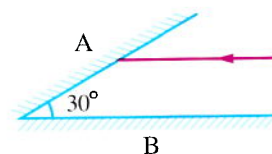
- 9 * In the opposite figure, a light ray is incident on mirror A while being parallel to mirror B, so:

- (i) The light ray gets reflected from mirror A and falls on mirror B at an angle of incidence that equals

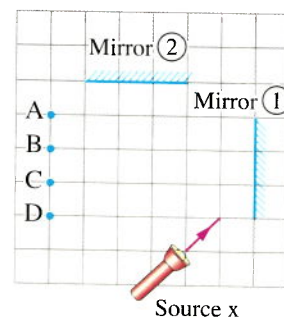
- (a) 90°
- (b) 60°
- (c) 30°
- (d) 0°

- (ii) The reflected light ray from mirror B falls again on mirror A with an angle of incidence that equals

- (a) 90°
- (b) 45°
- (c) 30°
- (d) 0°



- 10 * The opposite figure shows with a definite drawing scale the incidence of a laser ray from source x on mirror ①, hence after the ray gets reflected from mirror ②, it passes through point

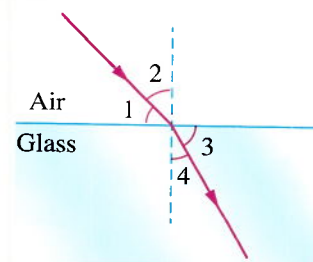


- (a) A (b) B
(c) C (d) D

► Light refraction

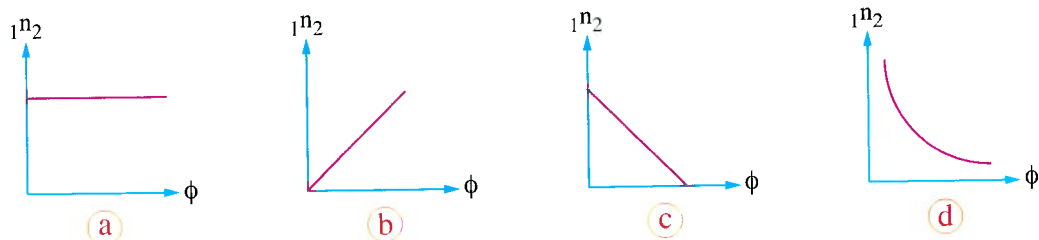
- 11 When a light ray is incident from air with an acute angle on a glass surface, its direction gets changed due to the change of between the two media.
- (a) the amplitude of light wave (b) the color of light
(c) the frequency of light (d) the speed of light
- 12 When a light wave passes from an optically rarer medium to another optically denser medium with an angle of incidence = zero, which of the following light properties does **not** change?
- (a) The wave speed. (b) The wavelength.
(c) The direction of propagation. (d) The wave amplitude.
- 13 The relative refractive index (${}_1n_2$) between two media is less than one when
- (a) the absolute refractive index of the first medium is smaller
(b) the frequency of light in the first medium is greater
(c) the speed of light in the first medium is greater
(d) the wavelength of light in the first medium is smaller
- 14 The opposite figure shows a light ray that is incident on a glass slab, so the angles of incidence and refraction are ,

	The angle of incidence	The angle of refraction
(a)	angle 1	angle 3
(b)	angle 1	angle 4
(c)	angle 2	angle 3
(d)	angle 2	angle 4

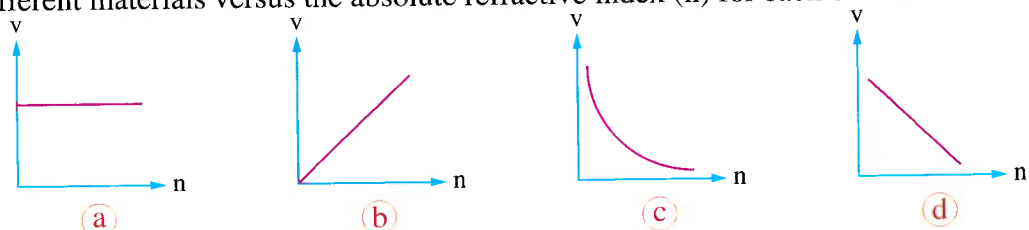


- 15 When the angle of incidence on the boundary surface between two media gets doubled, the relative refractive index between them
- (a) decreases to its half (b) gets doubled
(c) remains constant (d) increases by double its value

- 16 Which of the following graphs represents the relation between the relative refractive index (${}_1n_2$) between two media and the angle of incidence (ϕ) of the light beam on the boundary surface between them?



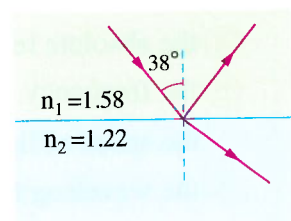
- 17 Which of the following graphs represents the variation of the speed of light (v) through different materials versus the absolute refractive index (n) for each of these materials?



- 18 When a light ray gets incident from air on water surface at an angle of incidence 60° , the angle of refraction will be

(a) greater than 60° (b) less than 60° (c) equal to 60° (d) equal to 0°

- 19 * A light ray is incident on the interface between two media having refractive indices as shown in the opposite figure, so the values of the angle of reflection and the angle of refraction are

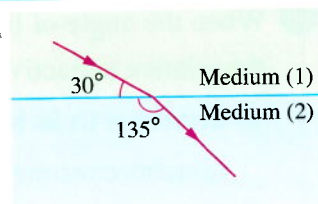


	The angle of reflection	The angle of refraction
(a)	38°	68.38°
(b)	52.88°	38°
(c)	28.38°	38°
(d)	38°	52.88°

- 20 A light ray is incident on the boundary surface between two transparent media. If the angle of incidence is 60° in medium (1) and the angle of refraction is 30° in medium (2), the relative refractive index from medium (1) to medium (2) equals

(a) 2 (b) $\sqrt{3}$ (c) $\sqrt{2}$ (d) $\frac{1}{2}$

- 21 The opposite figure shows a light ray falling from medium (1) on the boundary surface with medium (2), so the relative refractive index from medium (1) to medium (2) equals



(a) 1.52 (b) 1.48
(c) 1.34 (d) 1.22

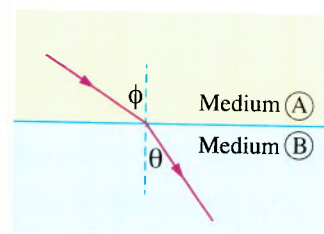
- 22 * A light ray is incident from air on the boundary surface with glass at an angle of 52° . If the ray is deviated by an angle of 19° , the refractive index of glass is

(a) 0.83 (b) 1.33 (c) 1.45 (d) 1.65

- 23 If the absolute refractive index of gasoline $n_1 = 1.5$ and the absolute refractive index of flint glass $n_2 = 1.66$, the relative refractive index from gasoline to flint glass (${}_1n_2$) equals

(a) 0.91 (b) 1.1 (c) 1.25 (d) 1.5

- 24 The opposite figure represents a light ray that travels from medium (A) to medium (B), so the ratio between the speed of light in medium (A) and the speed of light in medium (B) is

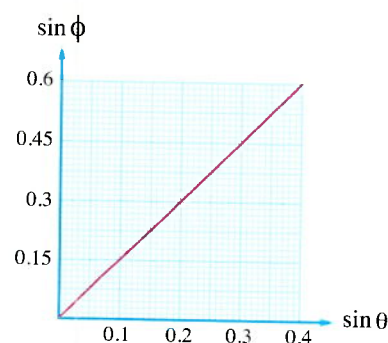


- (a) greater than 1
(b) less than 1
(c) equal to 1
(d) we can't determine the answer without knowing the values of ϕ , θ

- 25 A light ray is incident from air inclined to a glass surface at an angle of 50° with the surface. If the speed of light in air is 3×10^8 m/s and its speed in glass is 1.92×10^8 m/s, the angle of refraction of the light ray in the glass equals

(a) 24.29° (b) 29.34° (c) 40° (d) 50°

- 26 The opposite graph represents the relation between the sine of the angle of incidence ($\sin \phi$) in a transparent medium (1) and the sine of the angle of refraction ($\sin \theta$) in another medium (2) when a light ray travels between them. If the speed of light in medium (1) is 2×10^8 m/s, then:



- (i) The relative refractive index from medium (1) to medium (2) equals

(a) 1.5 (b) 0.75 (c) 1.93 (d) 2

- (ii) The speed of light in medium (2) equals

(a) 2.33×10^8 m/s (b) 2×10^8 m/s (c) 1.5×10^8 m/s (d) 1.33×10^8 m/s

- 27 When a ray of light that has wavelength λ and frequency ν moves from air into another transparent medium of refractive index n , the frequency and the wavelength of that light in the transparent medium will be

	The frequency of the light in the medium	The wavelength of the light in the medium
(a)	ν	λ
(b)	ν	$\frac{\lambda}{n}$
(c)	$\frac{\nu}{n}$	λn
(d)	νn	λ

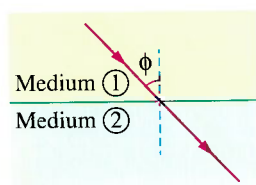
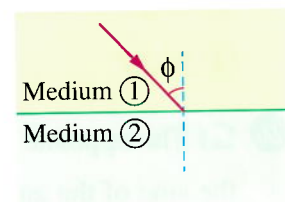
- 28 A red light ray is incident from air on the surface of glass. If the wavelength of red light in air is $7000 \text{ \AA}$ and the refractive index of glass is 1.5, the wavelength of red light in glass is approximately

(a) $10500 \text{ \AA}$ (b) $8564 \text{ \AA}$ (c) $5543 \text{ \AA}$ (d) $4667 \text{ \AA}$

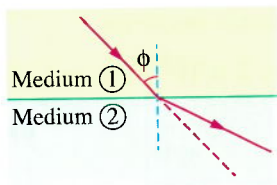
- 29 A ray of light has a wavelength 700 nm in air and 526 nm in water, so it travels in water with a speed of (Take: $c = 3 \times 10^8 \text{ m/s}$)

(a) $2.25 \times 10^8 \text{ m/s}$ (b) $2 \times 10^8 \text{ m/s}$ (c) $1.89 \times 10^8 \text{ m/s}$ (d) $1.76 \times 10^8 \text{ m/s}$

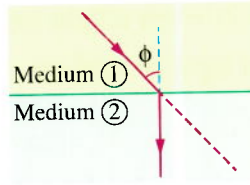
- 30 In the opposite figure, a light ray is incident with an angle ϕ on the boundary surface between two media (1), (2), hence if the ratio between the wavelengths light in the two media is $\left(\frac{\lambda_1}{\lambda_2} = \frac{3}{2}\right)$, the figure that represents the correct path of the ray is



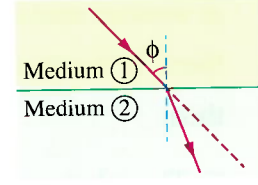
(a)



(b)



(c)



(d)

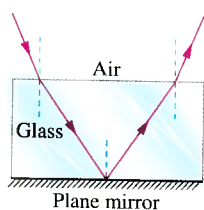
- 31 If the ratio between the refractive indices of two media $\left(\frac{n_1}{n_2}\right)$ is $\frac{2}{1}$, the ratio between the speeds of light in the two media $\left(\frac{v_1}{v_2}\right)$ is

(a) $\frac{2}{1}$ (b) $\frac{1}{2}$ (c) $\frac{4}{1}$ (d) $\frac{1}{4}$

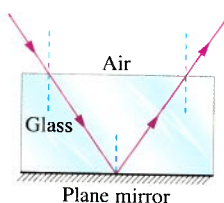
- 32 When a light ray is incident at an acute angle from a medium of refractive index 1.2 onto the surface of another medium of refractive index 1.5, then

	The speed of light	The ray gets refracted
(a)	increases	toward the normal line
(b)	decreases	toward the normal line
(c)	decreases	away from the normal line
(d)	increases	away from the normal line

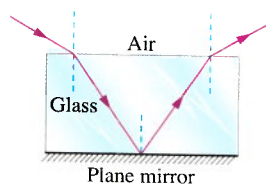
- 33 A monochromatic light ray falls from air into a cuboid of glass that is placed above a plane mirror, so the correct path of the ray is represented in figure



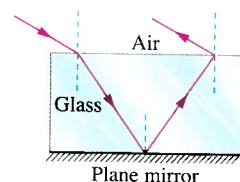
(a)



(b)



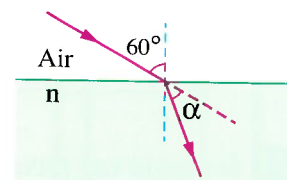
(c)



(d)

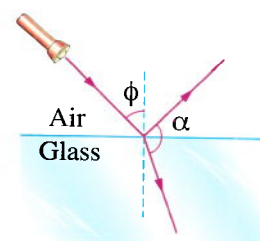
- 34 * In the opposite figure, which of the following values of refractive index (n) makes angle α larger?

- (a) 1.2 (b) 1.3
(c) 1.4 (d) 1.5



- 35 In the opposite figure, a light ray passes from air into a glass cuboid. If the angle of incidence of the ray (ϕ) gets increased, the angle (α) between the reflected and the refracted light rays

- (a) increases (b) decreases
(c) may increase or decrease (d) won't change

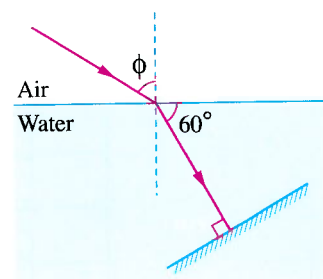


- 36 * The opposite figure shows a glass plate which is put perpendicular to the surface of a horizontal plane mirror. If a light ray falls at an angle of incidence 50° on the surface of the mirror, its angle of refraction in the glass plate will be

- (a) 51.6° (b) 47.2° (c) 35.8° (d) 25.9°



- 37 * In the opposite figure, a light ray passes from air into water, then gets reflected by a plane mirror under the surface of water, hence: (Take: $n_{\text{water}} = 1.33$)



(i) The angle of incidence (ϕ) equals

- (a) 22.41° (b) 30.58°
(c) 41.68° (d) 60.12°

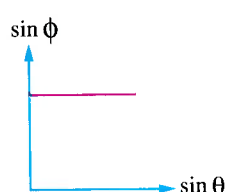
(ii) The angle of refraction when the ray emerges from water equals

- (a) 60° (b) 41.68° (c) 30.58° (d) 22.41°

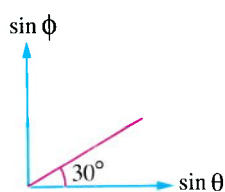
- 38 A light ray is incident from air on one of the faces of a glass cuboid to come out from the opposite face to air with an angle of emergence 50° . If the refractive index of glass is 1.53, so

	The angle of incidence in air	The angle of refraction inside the cuboid
(a)	40°	30°
(b)	40°	45°
(c)	50°	30°
(d)	50°	45°

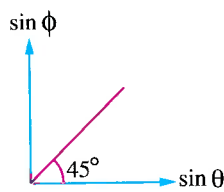
- 39 If a light ray travelled from a medium of refractive index n_1 to another medium of refractive index n_2 , where $n_2 > n_1$, the proper graph of $\sin \phi$ versus $\sin \theta$, when they are drawn with the same scale may be



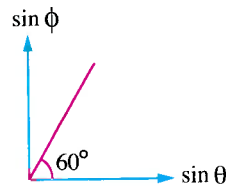
(a)



(b)

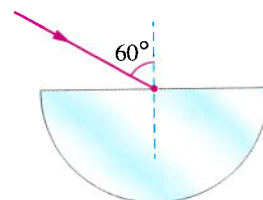


(c)



(d)

- 40 * In the opposite figure, a light ray is incident from air on the surface at the center of a glass hemisphere, so if the refractive index of glass is 1.5, the angle of emergence of the light ray from the glass equals



- (a) 0° (b) 30°
(c) 45° (d) 60°

- 41 * Figure (1) represents the incidence of a light ray from air onto the boundary surface of medium ①, if medium ① is changed with another medium ② as shown in figure (2), then

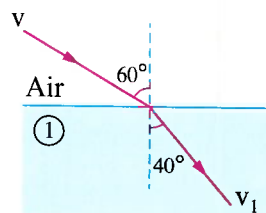


Figure (1)

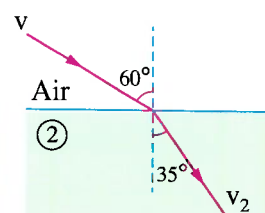
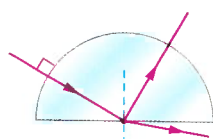


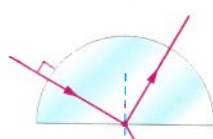
Figure (2)

	The relation between the refractive indices of the two media	The relation between the speeds of light in the two media
a	$n_1 > n_2$	$v_1 > v_2$
b	$n_1 > n_2$	$v_1 < v_2$
c	$n_1 < n_2$	$v_1 > v_2$
d	$n_1 < n_2$	$v_1 < v_2$

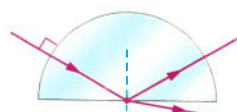
- 42 A ray of red light is incident perpendicular to the spherical surface of a hemisphere, so which of the following figures represents the correct path of the light ray?



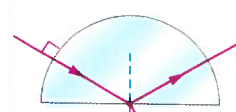
a



b



c



d

- 43 A light beam is incident perpendicular to a glass sheet of thickness d and refractive index n , so if the speed of light in empty space is c , the time interval taken by the light to pass through the sheet equals

a $\frac{nd}{c}$

b $\frac{d}{nc}$

c $\frac{dc}{n}$

d $\frac{c}{nd}$

- 44 If the absolute refractive index of water is 1.33, then the time taken by light to cover a distance of 20 m in water equals

(Knowing that: The speed of light in air = 3×10^8 m/s)

a 8.87×10^{-8} s

b 1.13×10^{-7} s

c 2.25×10^{-8} s

d 4.52×10^{-9} s

- 45 * The opposite figure represents a light ray travelling from air through a layer of liquid of thickness 4 m, if the speed of light in air equals 3×10^8 m/s, then:

(i) The refractive index of liquid equals

a 1.53

b 1.49

c 1.42

d 1.37

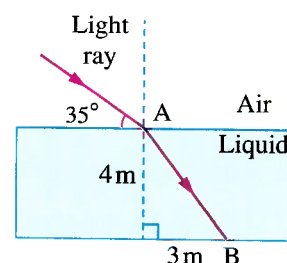
(ii) The time taken by the light ray to travel from point A to point B equals

a 2.28×10^{-10} s

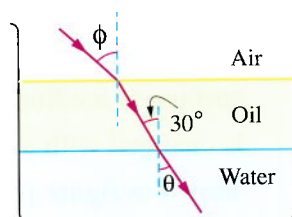
b 114×10^{-8} s

c 2.28×10^{-8} s

d 114×10^{-10} s

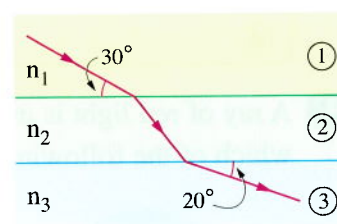


- 46 The opposite figure shows a light ray travelling from air into oil then into water. If the absolute refractive index of oil is 1.48 and of water is 1.33, then the angles (ϕ), (θ) are,



	ϕ	θ
a	41.6°	33.81°
b	41.6°	41.6°
c	47.73°	33.81°
d	47.73°	41.6°

- 47 * The opposite figure shows a light ray travelling through three different media, so the relation among:



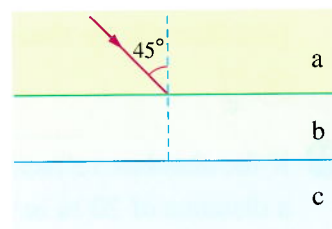
- (i) The absolute refractive indices of these media is demonstrated by

- a $n_3 > n_1 > n_2$ b $n_1 > n_2 > n_3$
 c $n_2 > n_1 > n_3$ d $n_2 > n_3 > n_1$

- (ii) The speeds of light in the three media is

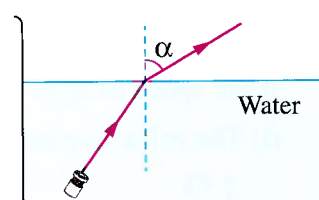
- a $v_1 > v_2 > v_3$ b $v_2 < v_1 < v_3$ c $v_1 > v_3 > v_2$ d $v_3 < v_1 < v_2$

- 48 * A light ray is incident to pass through three transparent media a, b and c as in the opposite figure. If the speed of light in medium a is 1.4 of its speed in medium b, the angle of incidence on the boundary surface between the two media b and c equals



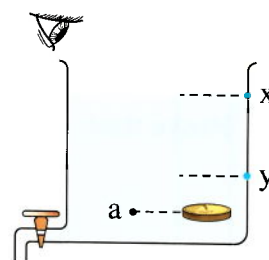
- a 30.34° b 34.30° c 59.7° d 81.87°

- 49 * In the opposite figure, a light ray passes from water to air to emerge with an angle α , so if another transparent immiscible liquid whose density is lower than water is poured slowly above water, the angle of emergence of the light ray to air will be



- a greater than α b less than α
 c equal to 90° d equal to α

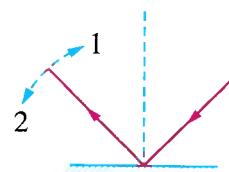
- 50 * The opposite figure shows a man looking constantly at a metal coin that is placed at the bottom of a container filled with water up to level x, hence the coin seems to him at specific position (a). When the tap is opened to let the water gets out gradually from the container till its surface becomes at level y, the man will see the image of the coin



- (a) rising up gradually (b) descending gradually
(c) stable at the bottom of the container (d) remained stable at its level (a)

Second Essay Questions

- 1 The opposite figure shows the reflection of a light ray. If the angle of incidence is increased, **does** the reflected ray change its path? And if it does, **in which direction** will it be changed? **Explain your answer.**



- 2 A light ray travelled from a medium of refractive index n_1 to another medium of refractive index n_2 .

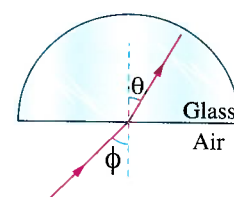
Show by drawings the path of the light ray through the two media if:

- (a) $n_2 < n_1$ (b) $n_2 > n_1$

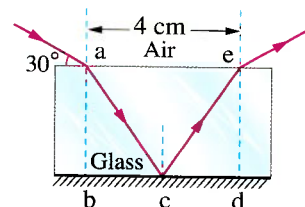
- 3 **Explain the following statements:**

- (1) It is easier to see your reflected image on the glass of a window from the inside of a lighted room at night when the outside is dark than seeing your image at daytime when there is light outside.
(2) The absolute refractive index for any medium is always greater than one however the relative refractive index may be less or greater than one.

- 4 The opposite figure shows a red light ray falling on a semi-circular prism. **Will** the angle of refraction change if a blue light ray is incident at the same angle instead of the red light? **Explain your answer.**

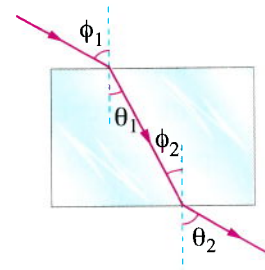


- 5 The opposite figure represents the path of a light ray while being incident on a glass cuboid of refractive index $\sqrt{3}$ that is placed above a plane mirror until it emerges from the cuboid to the air, **what** is the thickness of the cuboid (ab or ed)?



- 6 The opposite figure shows the path of a light ray falling from air on a glass block.

Prove that: $\phi_1 = \theta_2$



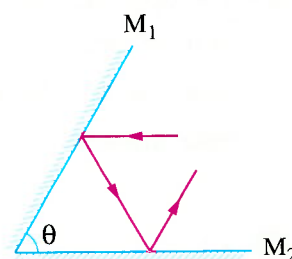
Questions that measure high levels of thinking

Answered in detail

Choose the correct answer:

- 1 In the opposite figure, a light ray is incident on mirror M_1 parallel to mirror M_2 , hence the ray gets reflected from mirror M_1 to fall on mirror M_2 and get reflected from it parallel to mirror M_1 , so angle θ equals

- (a) 30° (b) 45°
(c) 60° (d) 90°



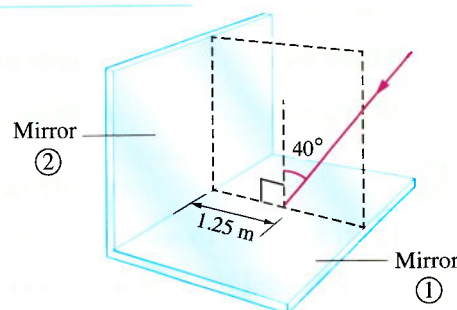
- 2 The opposite figure represents two perpendicular plane mirrors (1), (2). A light ray is incident on mirror (1) at an angle of incidence 40° , so:

- (i) The angle of reflection of the ray from mirror (2) equals

- (a) 40° (b) 50°
(c) 60° (d) 90°

- (ii) The distance covered by the reflected ray from the position of its reflection from mirror (1) till striking mirror (2) equals

- (a) 0.8 m (b) 0.98 m (c) 1.94 m (d) 2.5 m



- 3 Each of the following figures represents the path of a light ray when it travels between two media,

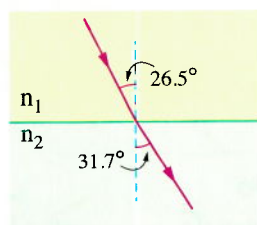


Figure (1)

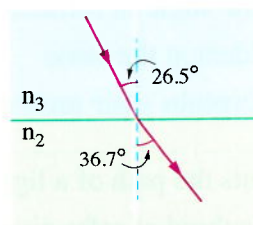


Figure (2)

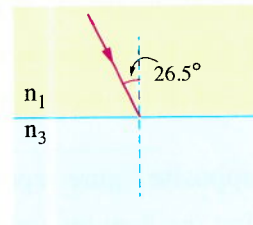


Figure (3)

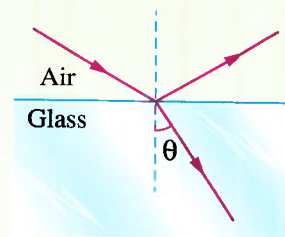
so using the known angles in these figures, the angle of refraction of the light ray in figure (3) equals

- (a) 41.7° (b) 30.5° (c) 23.1° (d) 18.6°

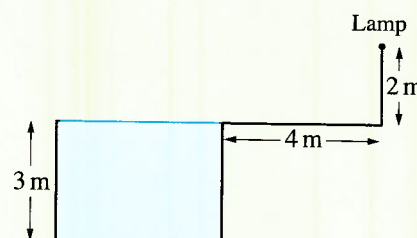
- 4 In the opposite figure, a light ray is incident on a glass slab of refractive index 1.5 such that the reflected and the refracted rays are perpendicular to each other, so the angle of refraction (θ) equals

(Where: $\sin(90 - \theta) = \cos \theta$)

- (a) 42.14° (b) 37.25° (c) 33.69° (d) 27.64°



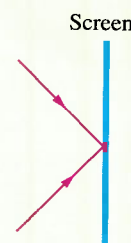
- 5 A swimming pool of depth 3 m is filled completely with water of refractive index $\frac{4}{3}$. To light up the bottom of the swimming pool, a lamppost of height 2 m is installed at a distance 4 m from the edge of the swimming pool as shown in the opposite figure, so the length of the dark part at the bottom of the swimming pool is



- (a) 1.07 m (b) 2 m (c) 2.71 m (d) 3.32 m

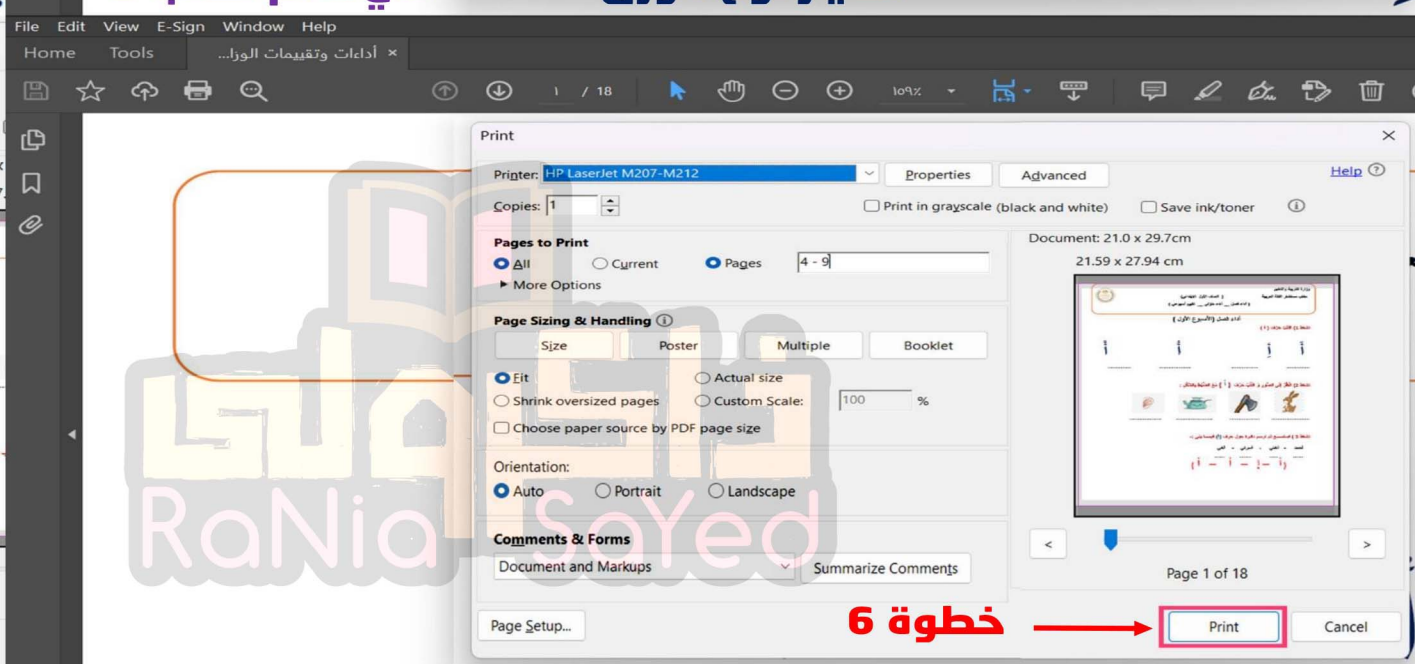
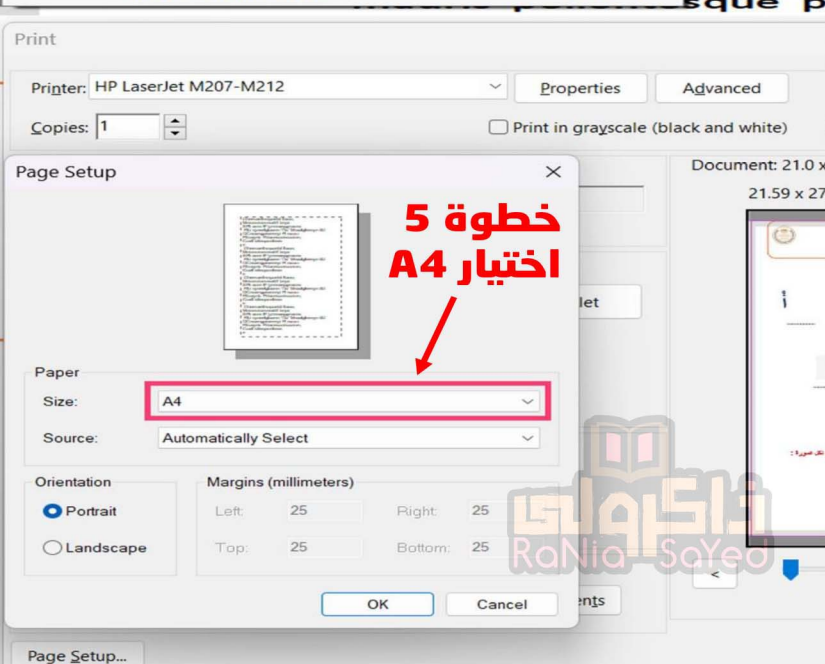
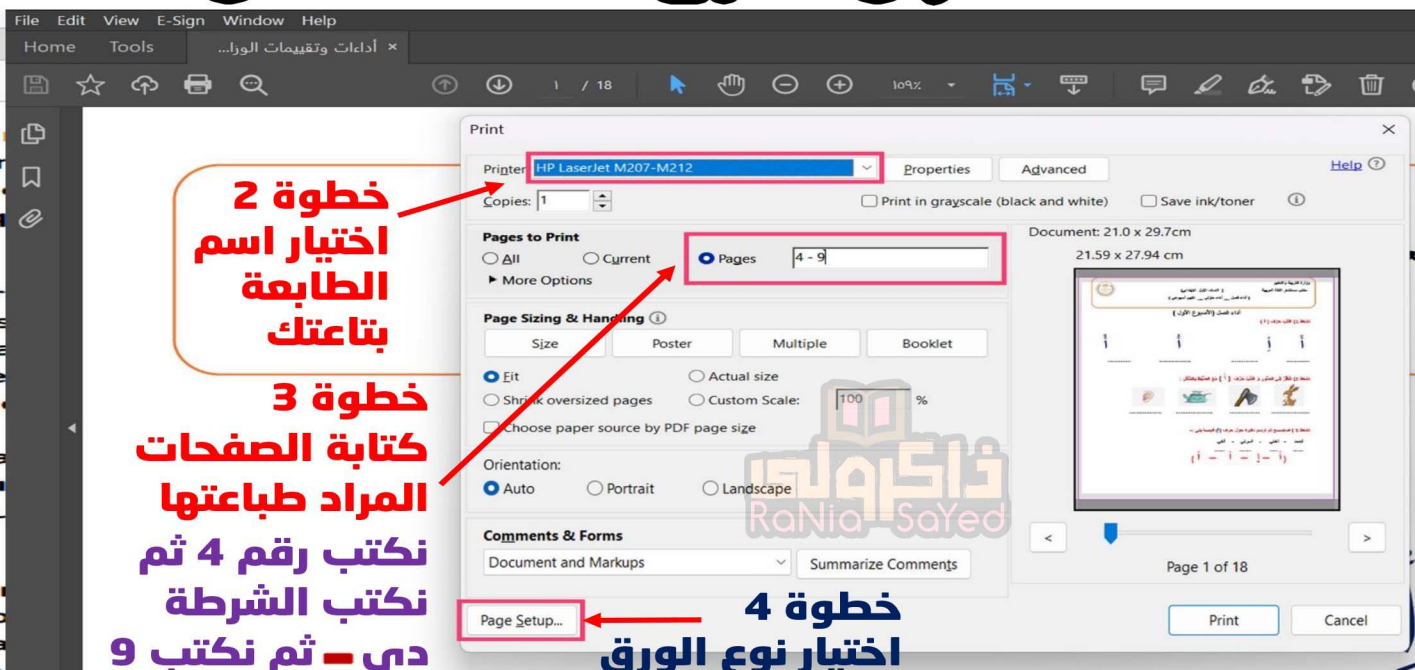
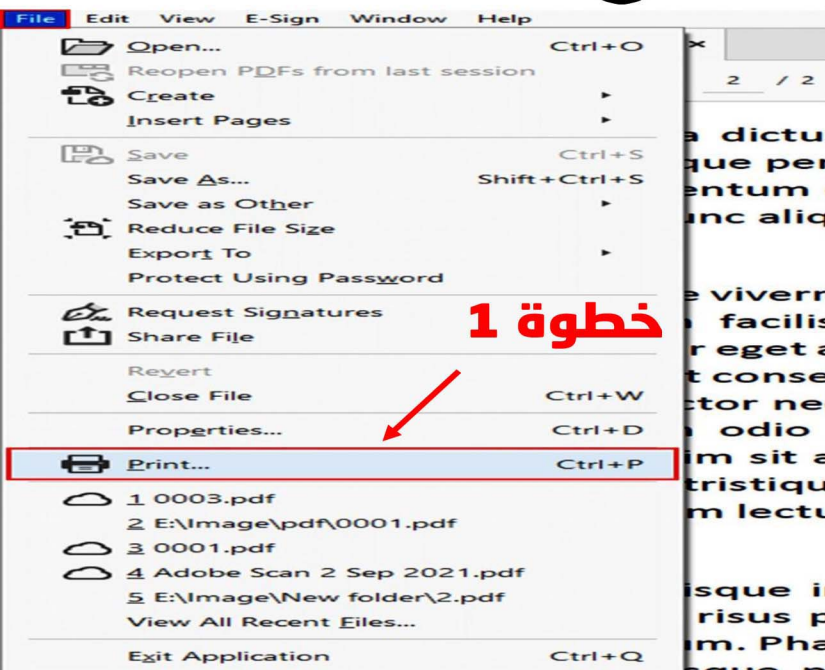
Answer the following question:

- 6 In the opposite figure, two light rays intersect at a point on a vertical screen. If a glass plate is put in front of the screen and parallel to it in the path of the two rays, will the two rays intersect on the screen? **Explain your answer.**



كيفية طباعة صفحات معينة من ملف معين

مثلا ازاي نطبع الصفحات من صفحة 4 الى صفحة 9



حمل الآن

مجاناً وحصرياً

المراجعة رقم (2)

اختبار شهر مارس





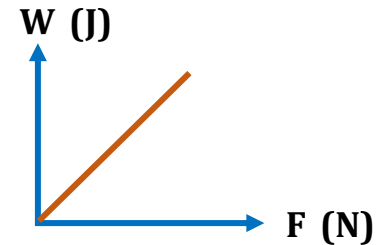
First: Multiple Choice Questions

- 1) If the force acting on a body is **doubled** while it moves through the same displacement, the work done
(A) increases to four times its value
(B) increases to double its value
(C) decreases to half its value
(D) remains constant
- 2) The work done by the braking force is
(A) positive
(B) negative
(C) equal to zero
(D) depends on the direction of motion relative to the force
- 3) When a body moves in a direction that makes an angle of 60° with the direction of the applied force, the work done is equal to
(A) zero
(B) maximum value
(C) half the maximum value
(D) less than the maximum value and greater than zero

- 4) The figure represents the graphical relationship between the work done (**W**) and the applied force (**F**) in the direction of displacement.

The slope of the graph represents

- (A) the work done
- (B) the applied force
- (C) the displacement of the body
- (D) the time taken to do the work



- 5) The type of work done by the tension force exerted by a person pulling a suitcase behind him as shown in the figure is

- (A) positive work
- (B) negative work
- (C) zero
- (D) depends on the speed of motion



- 6) Both **x** and **y** wanted to place a mass of **m** kg onto a platform at a height **h** m above the ground.



y lifted the mass vertically and placed it on the platform, while **x** used an inclined plane of length **2h** and pushed the mass upward along it. In this case,

- (A) the work done by **x** is greater than the work done by **y**.
- (B) the work done by **y** is greater than the work done by **x**.
- (C) the work done in both cases is equal, but the force of **x** is greater than **y**.
- (D) the work done in both cases is equal, but the force of **y** is greater than **x**.



7) The work required to push a cart through a distance of **3.5m** by a force of **20 N** acting in the same direction as the motion is equal to

- (A) 7 J
- (B) 20 J
- (C) 70 J
- (D) 140 J

8) If a force **F** acts on a body and displaces it from point **(A)** to point **(B)** through a distance of **2 m** in the same direction as the force, then the work done is **$W = 2F$** .

This is because



- (A) the magnitude of the applied force is equal to twice the displacement
- (B) work is directly proportional only to the magnitude of the force
- (C) the direction of the force makes an angle of 60° with the direction of displacement
- (D) the displacement is 2m and the force acts in the same direction as the displacement

9) A force of **100N** acts on a body producing a displacement of **2.5m**.

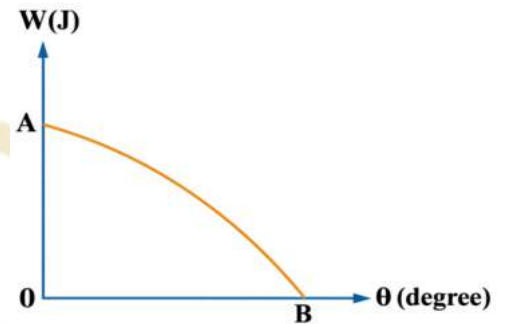
If the force is perpendicular to the direction of motion of the body, the work done is ...

- (A) 250 J
- (B) 125 J
- (C) 50 J
- (D) 0 J



- 10) A force of magnitude **100 N** acts on a body repeatedly, producing a displacement of **5 m** each time, while the angle (θ) between the directions of the force and the displacement is varied. The opposite graph represents the relationship between the work (**W**) done on the body by this force and the angle (θ). The value of the angle at point (**D**) is

- (A) 30°
- (B) 45°
- (C) 60°
- (D) 90°



- 11) A motorcycle of mass **200kg** moves along a straight line. If the engine force acting on it is **500N**, and the frictional force is **100N** for each **100kg** of its mass, the work done on the motorcycle when it travels a distance of **50m** is

- (A) 10000 J
- (B) 15000 J
- (C) 25000 J
- (D) 30000 J

- 12) A mother pushes her baby's stroller at constant speed along a straight horizontal road with a force making an angle of **60°** with the horizontal. If the stroller is subjected to a frictional force of **20N**, the work done by the mother on the stroller to move it through a distance of **5m** is

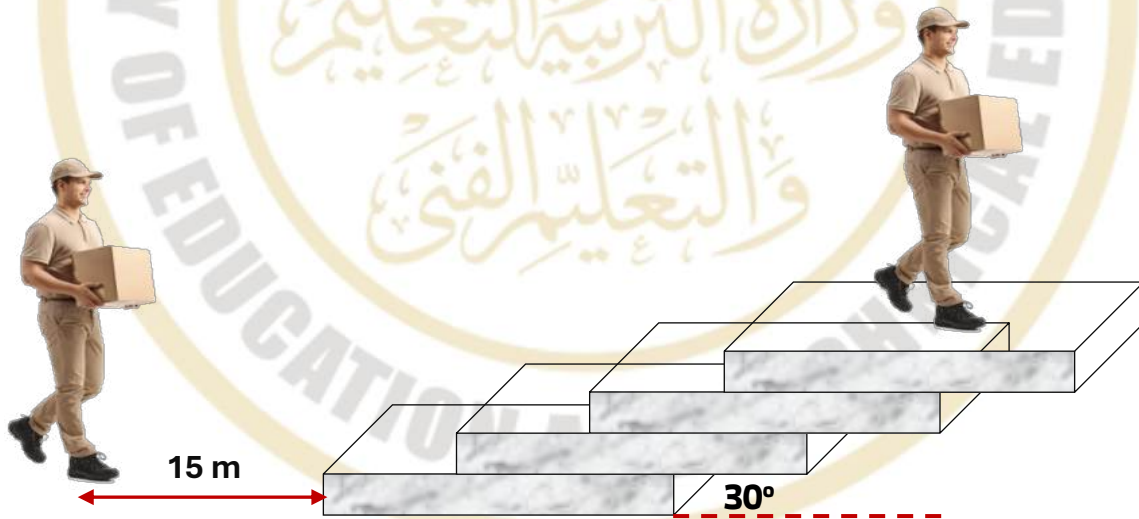
- (A) 50 J
- (B) 80 J
- (C) 100 J
- (D) 200 J



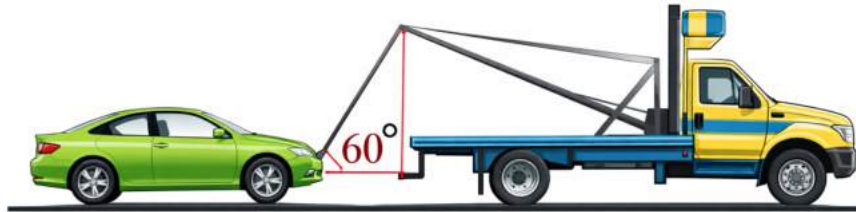
Second: Essay Questions

- 13) A student stated that work is a vector quantity because the vector (cross) product of two vector quantities, force and displacement, results in a vector quantity. Identify the error in this statement and state the correct concept.

- 14) A worker carries a box of mass **40kg**. He moves a horizontal distance of **15m**, then climbs a ladder of length **20m** inclined at an angle of **30°** to the horizontal, as shown in the figure. If the acceleration due to gravity is **10m s⁻²**, calculate the work done.



- 15) Winch pulls an illegally parked car along a horizontal road through a displacement of **1 km** using a rope, as shown in the figure. The work done on the car by the tension force in the rope is **$2.5 \times 10^5 \text{ J}$** . Calculate the tension in the rope.



- The end -

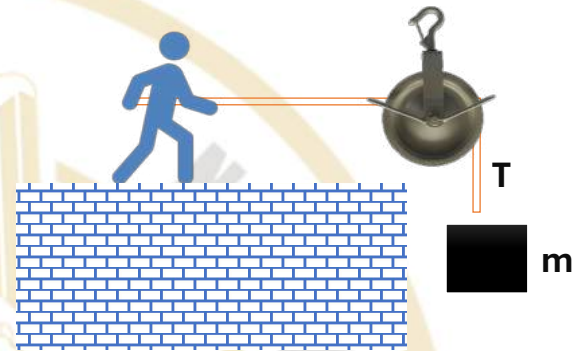
Chapter 1| Work

Group (A)

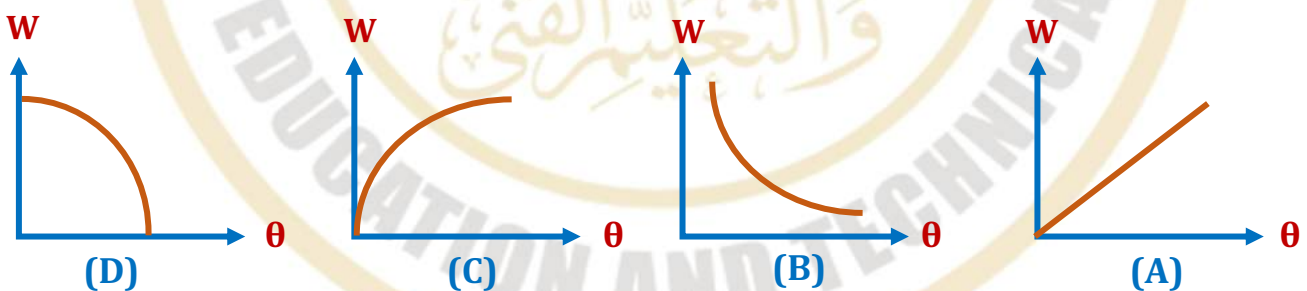
First: Multiple Choice Questions

1) In the shown figure, the work done by the force exerted by the person to lift a load upward using a pulley is

- (A) positive work
- (B) negative work
- (C) equal to zero
- (D) depends on the weight of the load



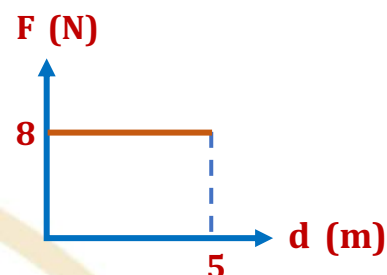
2) Which of the following graphs represents the relationship between the work done (W) on a body by a constant force acting on it and the angle (θ) between the directions of this force and the displacement of the body, assuming the displacement is constant?



- 3) The adjacent graph shows the relationship between the horizontal force F acting on a body and the horizontal displacement d produced by this force.

The work done on the body when the displacement is 5m is

- (A) 20 J
 (B) 30 J
 (C) 40 J
 (D) 50 J



- 4) Two horizontal forces act on a body placed on a smooth horizontal surface: a force of 9N to the right and a force of 3N to the left.

If these forces cause the body to move horizontally through a distance of 2m , the work done by the resultant force on the body is

- (A) 6 J
 (B) 9 J
 (C) 12 J
 (D) 18 J



Second: Essay Questions

- 5) Calculate the work done by a girl carrying a bucket of mass 300g while moving with it through a horizontal displacement of 10m .

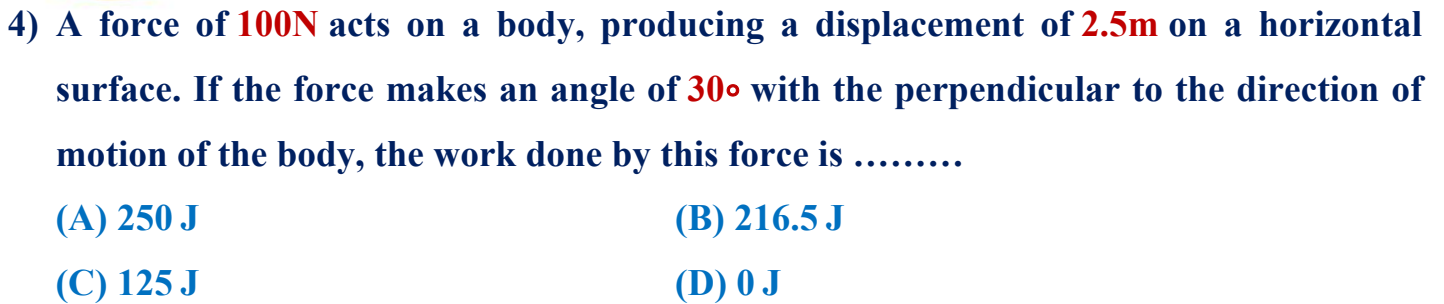
Then calculate the work done by a child to lift a bucket of the same mass through a vertical displacement of 10 cm .
 (Knowing that $g = 10\text{ m/s}^2$)

Group (B)

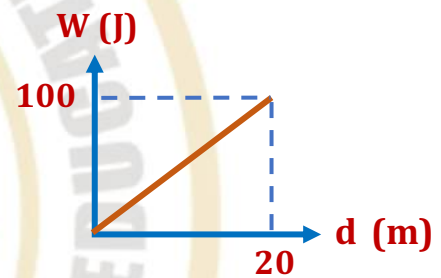
First: Multiple Choice Questions

- 1) A man pushes a wall but fails to move it. The work done by the man is
- (A) negative work
(B) positive but not maximum work
(C) no work is done at all
(D) maximum work
- 2) A rigid body moves a distance of **10m** along a straight line under the action of a force of **5N**.
If the work done by this force on the body is **25J**, the angle between the force and the direction of motion of the body is
- (A) 0° (B) 30°
(C) 60° (D) 90°
- 3) In the shown figure, a man of mass **70kg** walks along a horizontal pavement for a distance of **10m**. The work done by the man's weight on the pavement is
(Knowing that: $g = 10 \text{ m s}^{-2}$)
- (A) 7000 J
(B) 3500 J
(C) 700 J
(D) 0 J





5) The adjacent graph shows the relationship between the work done W on a body by a constant force F and the displacement d . If the angle between the force vector and the displacement is 60° , calculate the magnitude of the force F .



First: Multiple Choice Questions

- 1) Two trains (A) and (B) of masses m and $3m$, respectively, start from rest and move along a straight line under the action of constant resultant forces. Each train reaches the same speed after a time interval t .

The ratio of the magnitudes of the work done by the resultant forces acting on the two trains (W_A/W_B), when both trains travel the same distance, is

- (A) $\frac{1}{3}$ (B) $\frac{1}{2}$
(C) 1 (D) $\frac{2}{1}$



2) Which of the following angles between the force and the displacement gives the highest value of work among the listed angles?

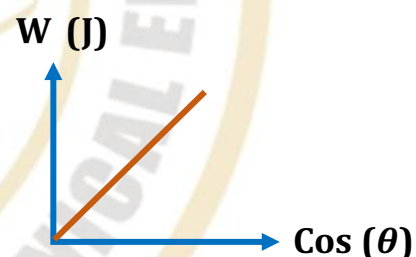
- (A) 30° (B) 45°
(C) 60° (D) 90°

3) A person pushes a body with a constant speed of 2 m s^{-1} for 10 s on a rough horizontal surface. If the frictional force between the body and the surface is 20 N , the work done by the person to move the body during this time is

- (A) 0 J (B) 30 J
(C) 400 J (D) 3000 J

4) The opposite graph represents the relationship between the work done W by a constant force acting on a body and $\cos \theta$, where θ is the angle between the direction of the force and the direction of displacement. The slope of the graph represents

- (A) $F \times d$ (B) F/d
(C) $F + d$ (D) $F - d$



Second: Essay Questions

5) A garden cart of mass 20 kg moves under the action of a pulling force of magnitude 50 N , making an angle of 60° with the horizontal. If the cart moves through a displacement of 4 m , calculate the work done by the force, neglecting friction.

- The end -



First: Multiple Choice Questions

1) A body has a kinetic energy of **2 J**. If its speed is doubled, its kinetic energy becomes ...

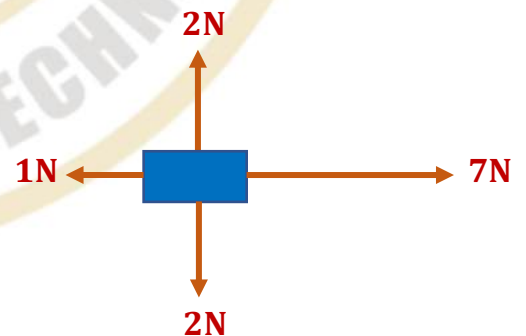
- (A) 4 J
- (B) 2 J
- (C) 6 J
- (D) 8 J

2) A car of mass **2000 kg** moves with a speed of **60 km/h**. Its kinetic energy is equal to

- (A) 1.39×10^5 J
- (B) 2.78×10^5 J
- (C) 5.56×10^5 J
- (D) 1×10^6 J

3) The figure shows a top view of the magnitudes and directions of four forces acting on a body placed on a horizontal surface. The change in the kinetic energy of the body while it is displaced through **4 m** is equal to

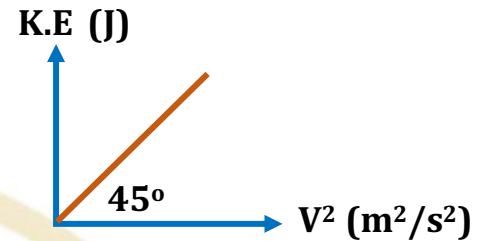
- (A) 8 J
- (B) 10 J
- (C) 24 J
- (D) 32 J



- 4) The opposite graph shows the relationship between the kinetic energy (**KE**) of a body of mass (**m**) and the square of its speed (**v²**). The mass of the body is

(Given that both quantities are plotted on the axes using the same scale)

- (A) 0.5 kg
- (B) 1 kg
- (C) 2 kg
- (D) 5 kg



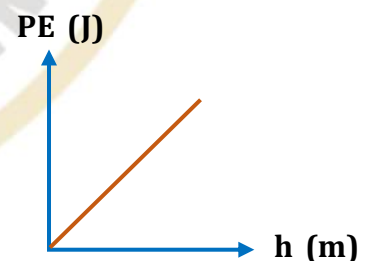
- 5) Two bodies have masses such that the mass of the first is **twice** the mass of the second, and the speed of the first is **half** the speed of the second. The kinetic energy of the first body is the kinetic energy of the second body.

- (A) half
- (B) double
- (C) quarter
- (D) four times

- 6) The opposite graph shows the relationship between potential energy (**PE**) and height (**h**).

The unit of the slope is

- (A) $\text{kg} \cdot \text{m}^2 \cdot \text{s}^2$
- (B) $\text{kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$
- (C) $\text{kg} \cdot \text{m} \cdot \text{s}^2$
- (D) $\text{kg} \cdot \text{m} \cdot \text{s}^{-2}$





7) A boy of mass **60 kg** climbs a palm tree of height **400 cm**. The potential energy of the boy at the maximum height is

(Given that $g = 10 \text{ m/s}^2$)

(A) 1200 J

(B) 2400 J

(C) 2000 J

(D) 1600 J

8) A man reaches his apartment once by climbing the stairs and once by using the elevator. Which of the following statements is correct?

(A) The man's potential energy is greater when he climbs the stairs

(B) The man's potential energy is greater when he uses the elevator

(C) The man has no potential energy when using the elevator

(D) The man's potential energy is the same in both cases

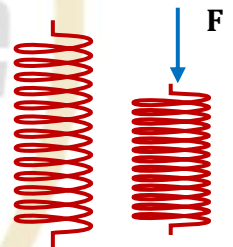
9) When a spring is compressed, the energy it possesses is energy.

(A) kinetic

(B) mechanical

(C) potential

(D) magnetic



10) When a body falls from the top of a building of height (**d**) with an acceleration due to gravity (**g**) in a time (**t**), the value of the body's potential energy at the moment of release is

(A) equal to its kinetic energy

(B) double its kinetic energy

(C) its momentum

(D) maximum



- 11) Hassan wants to lift a box of mass (**m**) vertically through a distance of **1 m**. The force required by Hassan is equal to
- (A) half the weight of the box
 - (B) the weight of the box
 - (C) one quarter of the weight of the box
 - (D) one third of the weight of the box
- 12) If a body of mass **2 kg** is at a height of **5 m** above the ground, and $g = 9.8 \text{ m/s}^2$, then its potential energy is
- (A) 9.8 J
 - (B) 2.5 J
 - (C) 10 J
 - (D) 98 J

Second: Essay Questions

- 13) Two boxes (**A**) and (**B**) with weights **40 N** and **60 N**, respectively. Box (**A**) is placed on the ground, while box (**B**) is placed at a height of **2 m** above the ground. To what height must box (**A**) be raised so that it has the same gravitational potential energy as box (**B**)?



- 14) A ladder of length **6 m** rests against a vertical wall, making an angle of **30°** with the ground. A man of mass **70 kg** climbs the ladder. Calculate the **work done** by the man to reach the top of the ladder, the **gravitational potential energy** of the man at the top of the ladder and **what** do you deduce from your results?

- The end -



Chapter 1| Energy

Group (A)

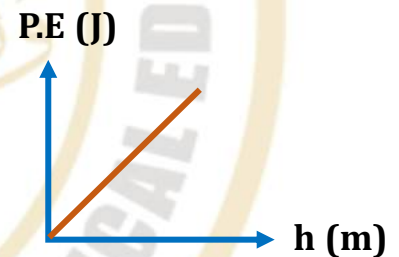
First: Multiple Choice Questions

1) A body has a kinetic energy of **4 J**. What will its kinetic energy be if its speed is doubled?

- (A) 0.8 J
- (B) 4 J
- (C) 16 J
- (D) 8 J

2) The slope of the straight line in the opposite graph represents the

- (A) mass of the body
- (B) weight of the body
- (C) displacement of the body
- (D) velocity of the body



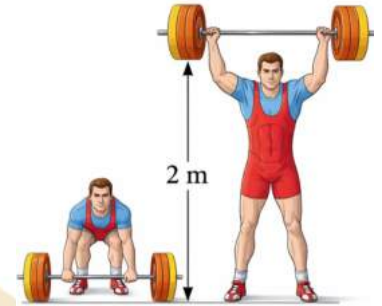
3) If a body is projected vertically upward, which of the following physical quantities becomes **zero** at the maximum height?

- (A) its weight
- (B) its acceleration
- (C) its potential energy
- (D) its velocity

- 4) The opposite figure shows a weightlifter lifting a mass of **100 kg**. The work done by the weightlifter to raise the mass from the ground to a height of **2 m** is

(Given that: $g = 10 \text{ m/s}^2$)

- (A) 100 J
- (B) 200 J
- (C) 1000 J
- (D) 2000 J



Second: Essay Questions

- 5) Calculate the work done to lift a body of mass **50 kg** through a height of **2.2 m** above the ground surface.

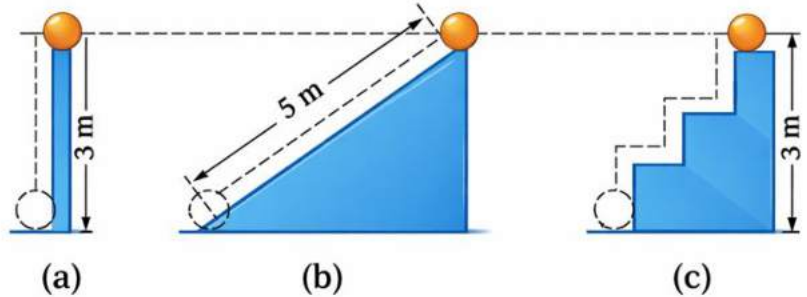
Group (B)

First: Multiple Choice Questions

- 1) A body of mass **m** is located near the Earth's surface. If its gravitational potential energy at a point **5 m** above the ground is **980 J**, and the acceleration due to gravity is $g = 9.8 \text{ m/s}^2$, what is the mass of the body?
- (A) 20 kg
 - (B) 50 kg
 - (C) 100 kg
 - (D) 196 kg

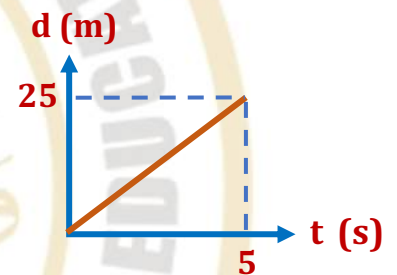
2) The opposite figures show three different frictionless paths that a stationary ball at ground level can follow to reach a certain height. Along which path is the work done in lifting the ball the greatest?

- (A) Path (a)
- (B) Path (b)
- (C) Path (c)
- (D) Equal in all three paths



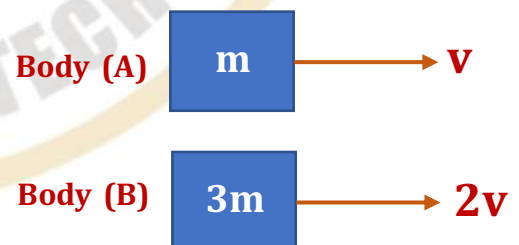
3) The opposite graph shows a displacement–time curve for the motion of a body of mass **20 kg**. The kinetic energy of this body is equal to

- (A) 25 J
- (B) 50 J
- (C) 125 J
- (D) 250 J



4) The opposite figure shows two bodies (A) and (B) of masses **m** and **3m**, moving with uniform speeds **v** and **2v**, respectively. If the kinetic energy of body (A) is **K.E**, then the kinetic energy of body (B) is

- (A) 2 K.E
- (B) 4 K.E
- (C) 6 K.E
- (D) 16 K.E



Second: Essay Questions

- 5) The opposite figure shows a table raised **0.5 m** above the ground surface, on which a book of mass **2 kg** is placed. Calculate its gravitational potential energy.

(Given that: $g = 9.8 \text{ m/s}^2$)



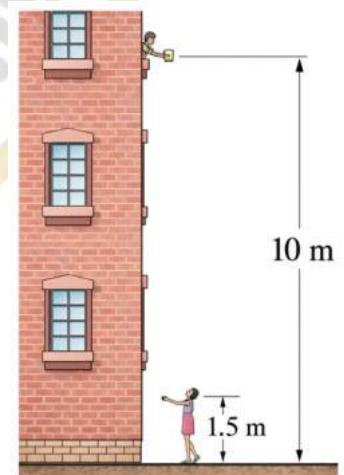
Group (C)

First: Multiple Choice Questions

- 1) In the opposite figure, a person drops a body of mass **0.2 kg** from a height of **10 m** above the ground surface, and another person catches it with his hands at a height of **1.5 m** above the ground. The decrease in the gravitational potential energy of the body is equal to

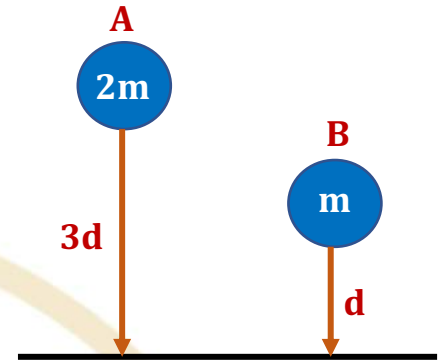
(Given that: $g = 10 \text{ m/s}^2$)

- (A) 8.5 J
(B) 10 J
(C) 17 J
(D) 20 J



2) Two bodies (A) and (B) fall freely toward the ground surface from the heights shown in the figure. The ratio of their kinetic energies at the moment they strike the ground, $(KE)_A/(KE)_B$, is equal to

- (A) $1/3$
- (B) $3/1$
- (C) $1/6$
- (D) $6/1$

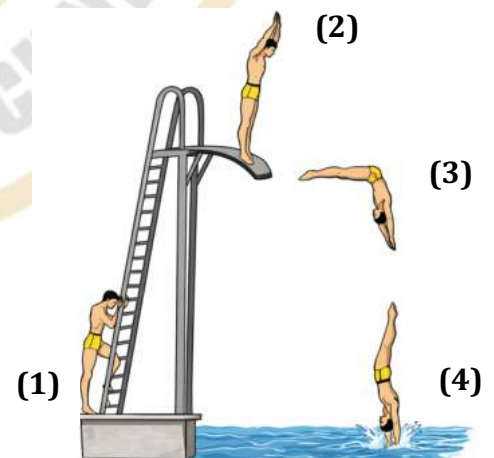


3) A stone is projected vertically upward from the ground surface with a certain velocity and reaches a height of **12 m**. If the same stone is projected upward with the same velocity on the surface of the Moon, the height it reaches is

- (Given that the acceleration due to gravity on the Moon is $1/6$ of that on Earth)
- (A) 2 m
 - (B) 12 m
 - (C) 28 m
 - (D) 72 m

4) In the opposite figure, which of the following statements is correct?

- (A) The potential energy at point (1) is greater than the potential energy at point (2)
- (B) The kinetic energy at point (4) is greater than the kinetic energy at point (3)
- (C) The speed at point (3) is equal to zero
- (D) The potential energy decreases gradually as the man moves from position (2) to position (4)



Second: Essay Questions

- 5) The **opposite graph** represents the variation of the kinetic energy of a body of mass **m** with time. Does the body move with uniform speed or variable speed? Why?



- The end -

Chapter 1| Law of conservation of energy

First: Multiple Choice Questions

- 1) A body is falling freely in the Earth's gravitational field, neglecting air resistance. At a certain instant, its kinetic energy is **40 J**. If its potential energy decreases by **10 J** during its motion, then its kinetic energy after that becomes:
- (A) 30 J (B) 40 J
(C) 50 J (D) 10 J
-
- 2) When a ball is thrown vertically upward (neglecting air resistance), during its upward motion:
- (A) Kinetic energy increases, potential energy decreases, and their sum increases
(B) Kinetic energy decreases, potential energy increases, and their sum remains constant
(C) Kinetic energy decreases, potential energy increases, and their sum decreases
(D) Kinetic energy increases, potential energy increases, and their sum remains constant
-
- 3) A bird of mass **0.3 kg** is flying at a height of **50 m** above the ground with a speed of **12 m/s**. The mechanical energy of this bird equals
- Given that $g = 10 \text{ m/s}^2$
- (A) 150 J
(B) 171.6 J
(C) 180 J
(D) 21.6 J



- 4) A body of mass **2 kg** is released from rest and falls freely toward the ground from a height of **4 m**. When its speed becomes **5 m/s**, the distance it has fallen equals ..

Given that $g = 10 \text{ m/s}^2$

- (A) 3.5 m
- (B) 2.75 m
- (C) 1.25 m
- (D) 1 m

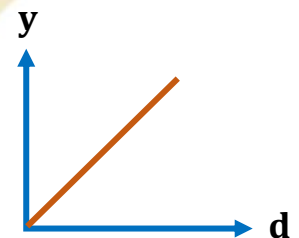
- 5) Two bodies **A** and **B** have the same mass. They are thrown vertically upward from the ground with speeds **v** and **2v**, respectively.

The ratio of the mechanical energy gained by each of them (E_A/E_B) equals

- (A) 4 / 1
- (B) 1 / 1
- (C) 1 / 2
- (D) 1 / 4

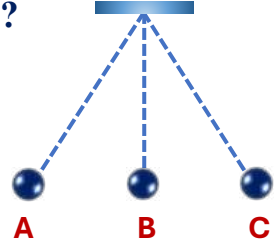
- 6) A body falls freely from a height **h** above the ground. The opposite graph represents the relationship between a physical quantity **y** and the distance **d** traveled by the body from the point of release toward the ground. The quantity **y** represents ...

- (A) The mass of the body
- (B) The kinetic energy of the body
- (C) The potential energy of the body
- (D) The mechanical energy of the body





7) The opposite figure shows a simple pendulum oscillating between positions **A** and **C**, passing through position **B**. Which of the following statements is correct?



- (A) The speed of the pendulum at A equals its speed at C
- (B) The kinetic energy at B equals zero
- (C) The potential energy at B is greater than the potential energy at A
- (D) The mechanical energy of the pendulum at A is greater than that at B

8) A ball of mass **1 kg** is thrown vertically upward with an initial speed of **10 m/s**. Neglecting air resistance, and given that the acceleration due to gravity is $g = 10 \text{ m/s}^2$. The maximum height reached by the ball equals

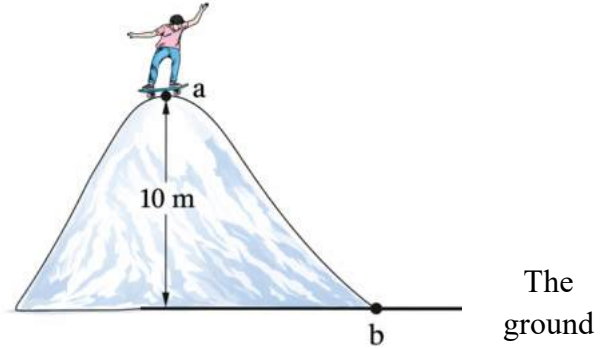
- (A) 2.5 m
- (B) 5 m
- (C) 7.5 m
- (D) 10 m

Second: Essay Questions

9) A cart of mass **500 kg** starts moving from rest from a height of **30 m**. Assuming that there is no friction, calculate its speed when it reaches the bottom of the slope.

10) The figure shows a skier of weight **500 N**. If the skier is at rest at point **(a)**, find:

- (a) The gravitational potential energy of the skier at point **a**
- (b) The gravitational potential energy of the skier at point **b**
- (c) The mechanical energy of the skier at point **b**



- The end -

Chapter 1| Law of conservation of energy

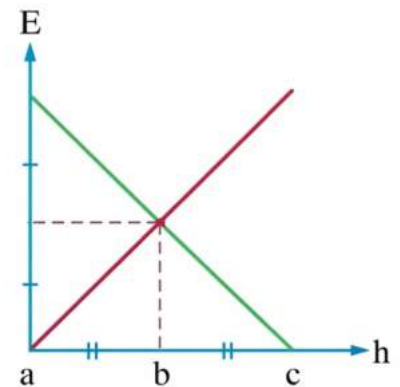
Group (A)

First: Multiple Choice Questions

- 1) The graph shows the relationship between two forms of energy (**E**) for a body of mass **10 kg** and its height (**h**) above the ground, when it is thrown vertically upward until it reaches a maximum height of **20 m**. The mechanical energy of the body during its motion at point (**b**) is equal to:

Given that $g = 10 \text{ m/s}^2$

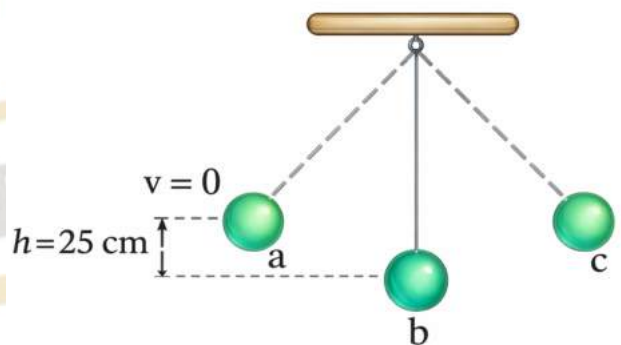
- (A) 500 J
- (B) 1000 J
- (C) 2000 J
- (D) 3000 J



- 2) The figure shows a ball suspended by a string and swinging freely in a vertical plane. The maximum speed reached by the ball during its motion is:

Given that $g = 9.8 \text{ m/s}^2$

- (A) 1.1 m/s
- (B) 2.2 m/s
- (C) 3.3 m/s
- (D) 4.4 m/s

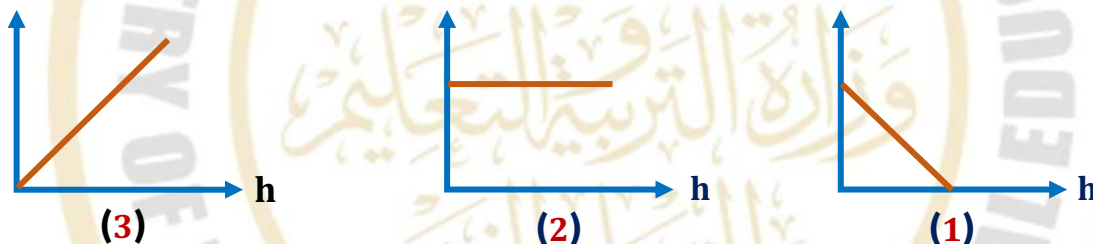


3) In all of the following systems, energy is transformed from potential energy to kinetic energy except:

- (A) An arrow when it is released from a bow
- (B) Water falling from a dam
- (C) A cart while moving up a hill
- (D) A long jump athlete during landing

Second: Essay Questions

4) A body is thrown vertically upward. Three graphs (1), (2), and (3) show how certain physical quantities of the body vary with its height (h) above the ground. Determine which graph represents the relationship between:

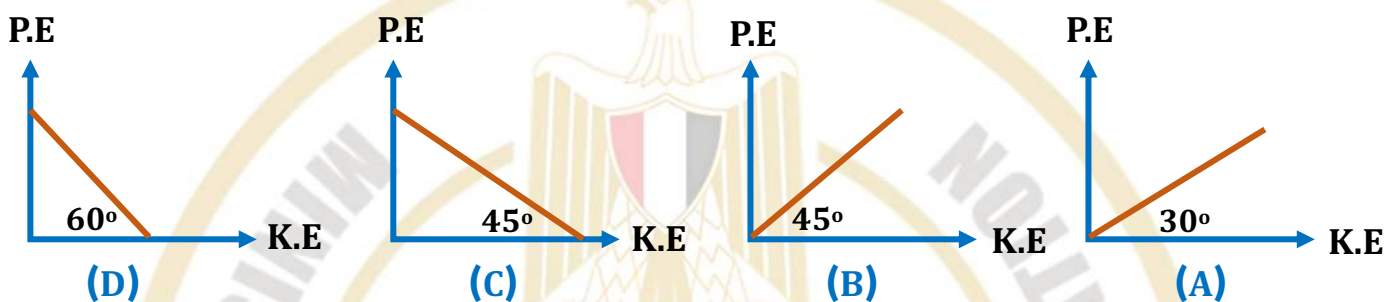


1. The gravitational potential energy (**PE**) of the body and its height (**h**)
2. The kinetic energy (**KE**) of the body and its height (**h**)
3. The mechanical energy (**E**) of the body and its height (**h**)

Group (B)

First: Multiple Choice Questions

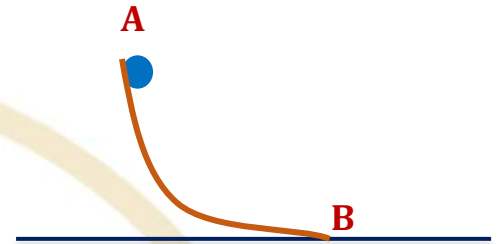
- 1) The **graph** that represents the variation of kinetic energy (**K.E**) with potential energy (**P.E**) for a body in free fall in the Earth's gravitational field from a certain height, when both quantities are plotted using the same scale, is



- 2) A tennis ball and a bowling ball are dropped together from the same height inside an evacuated chamber (vacuum). When they reach half of the vertical height, they have the same:
- (A) Speed
 - (B) Potential energy
 - (C) Kinetic energy
 - (D) Mechanical energy
- 3) A body starts to fall freely. At the instant when its potential energy decreases by **100 J**. From its initial value at the beginning of the fall, its kinetic energy is:
- (A) 50 J
 - (B) 100 J
 - (C) 200 J
 - (D) 400 J

Second: Essay Questions

- 4) A ball slides from rest along a smooth (frictionless) track. Compare the potential energy, kinetic energy, and mechanical energy of the ball at points **A** and **B**.



Group (C)

First: Multiple Choice Questions

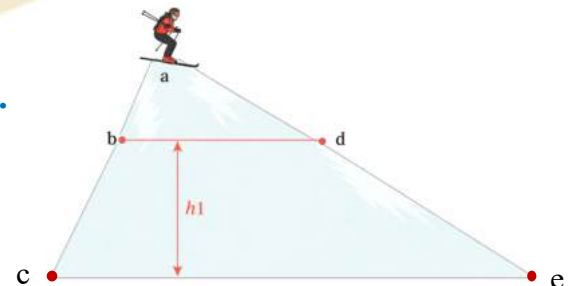
- 1) A ball of mass **2 kg** falls freely from a height of **4 m**. The kinetic energy of the ball at the midpoint of the falling distance is:

Given that $g = 10 \text{ m/s}^2$

- (A) 20 J (B) 200 J
(C) 160 J (D) 40 J

- 2) A skier stands at the top of a mountain and can slide down only one side. The two sides are smooth (frictionless), but each has a different slope, as shown in the figure. Which of the following statements is correct?

- (A) Points a and d have the same mechanical energy.
(B) Points e and c have the same potential energy.
(C) Points d and b have the same kinetic energy.
(D) All of the above.





- 3) When a ball is thrown vertically downward in air, neglecting air resistance, during its downward motion:
- (A) Kinetic energy increases, potential energy increases, and their sum remains constant
 - (B) Kinetic energy increases, potential energy decreases, and their sum remains constant
 - (C) Kinetic energy decreases, potential energy decreases, and their sum decreases
 - (D) Kinetic energy decreases, potential energy increases, and their sum remains constant

Second: Essay Questions

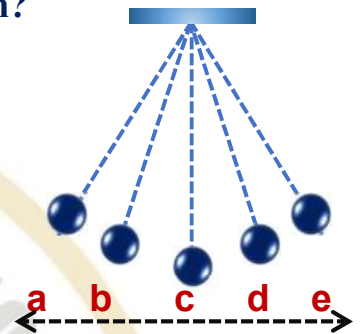
- 4) A body of mass **2 kg** is released from rest and falls freely from a height of **4 m** above the ground. Calculate the height of the body above the ground when its speed becomes **5 m/s**. Given that $g = 10 \text{ m/s}^2$

- The end -

First: Multiple Choice Questions

1) The opposite figure illustrates a simple pendulum. Which of the following pairs of points represents a distance equal to the amplitude of vibration?

- (A) a , e
- (B) b , e
- (C) a , d
- (D) c , a



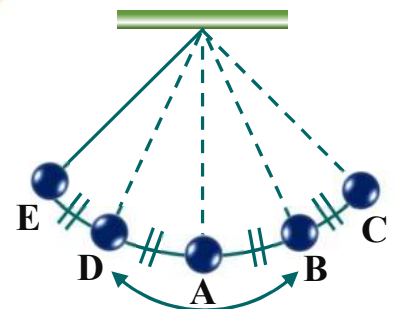
2) The opposite figure shows one arm of a tuning fork. Which of the following represents one complete vibration?

- (A) A $\rightarrow$ C $\rightarrow$ B
- (B) A $\rightarrow$ C $\rightarrow$ A
- (C) B $\rightarrow$ C $\rightarrow$ B
- (D) B $\rightarrow$ C $\rightarrow$ A



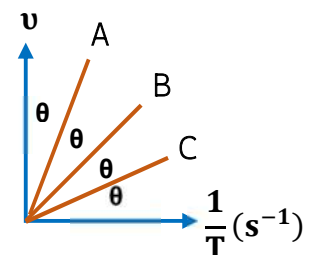
3) A simple pendulum oscillates between points A, B, C, D, and E as shown in the figure. The ratio of the time taken for displacement $\overrightarrow{AD}$ to the time taken for displacement $\overrightarrow{AB}$ equals ...

- (A) 1/2
- (B) 1/4
- (C) 1/3
- (D) 1/1



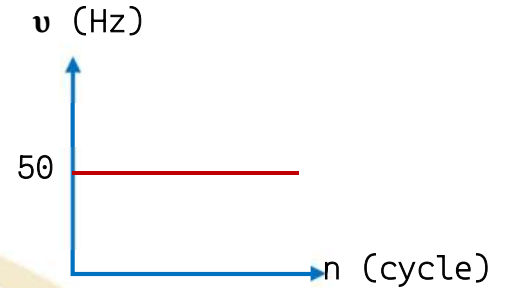


- 4) The maximum displacement of a vibrating string takes **0.002 s**, so the frequency equals ... Hz
- (A) 250 (B) 125
(C) 500 (D) 1000
- 5) If the number of complete vibrations made by a vibrating body is **1800 vibrations** per minute, then the frequency equals
- (A) 0.6 Hz (B) 1.5 Hz
(C) 30 Hz (D) 90 Hz
- 6) A vibrating body has a frequency equal to **9 times** its time period, so the periodic time equals s
- (A) 1/3
(B) 1/9
(C) 1/81
(D) 1
- 7) Three students **A**, **B**, and **C** drew graphs representing the relationship between the reciprocal of the time period and the frequency. If all the angles are equal, the correct evaluation of the students' graphs is:
- (A) Student A is correct, and students B and C are incorrect
(B) Student B is correct, and students A and C are incorrect
(C) Student C is correct, and students A and B are incorrect
(D) Students A and B are incorrect, and student C is incorrect



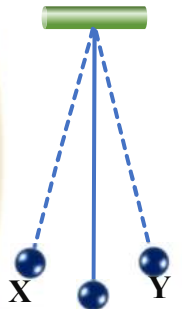
8) The opposite graph shows the relationship between the number of vibrations of a vibrating body and its frequency. The periodic time equals

- (A) 50 s
- (B) 0.2 s
- (C) 0.02 s
- (D) 0.002 s

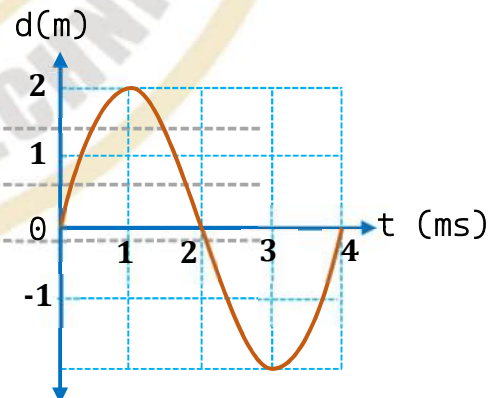


Second: Essay Questions

9) In the opposite figure, if the pendulum moves from point X to point Y in a time interval of 0.1 s, calculate the frequency of this pendulum.



1) The opposite graph illustrates the motion of a vibrating body. Calculate the frequency of this body

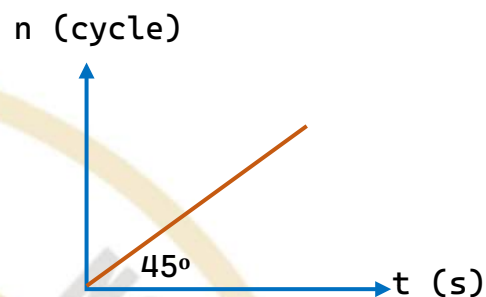


- The end -

**First: Multiple Choice**

1) From the opposite graph, the frequency equals

- (A) Half the periodic time
- (B) The periodic time
- (C) Twice the periodic time
- (D) The time of amplitude

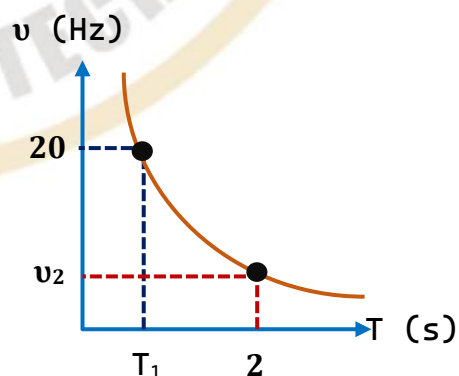


2) When a vibrating body is at its maximum displacement from its equilibrium position, which of the following becomes **zero**?

- (A) Its velocity and kinetic energy
- (B) Its velocity and potential energy
- (C) Its potential energy and kinetic energy
- (D) Its velocity and mechanical energy

3) The opposite graph illustrates the relationship between the time period and the frequency of a vibrating body. Calculate:

	ν_2	T_1
(A)	0.5 Hz	0.05 s
(B)	0.05 Hz	0.05 s
(C)	0.05 Hz	0.5 s
(D)	0.5 Hz	0.5 s





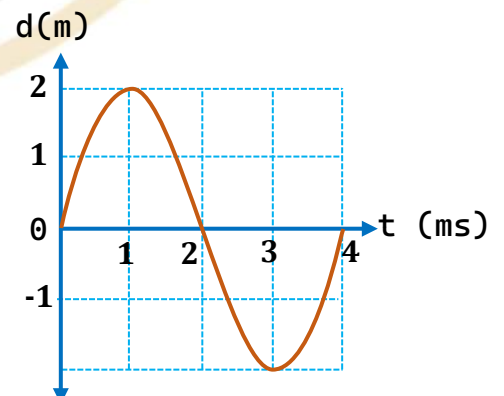
Second: Essay

- 4) A washing machine rotates at a rate of **1200 revolutions** per minute (rpm). Calculate the rotational frequency in hertz (Hz).

Group (B)

First: Multiple Choice

- 1) The time of amplitude of a vibrating body is **4 ms**, so the frequency equals
- (A) 250 Hz
(B) 62.5 Hz
(C) 0.004 Hz
(D) 0.016 Hz
- 2) The opposite graph illustrates the motion of a vibrating body. The frequency of this body equals
- (A) 250 Hz
(B) 0.25 Hz
(C) 4×10^{-3} Hz
(D) 4 Hz





3) When a vibrating body is at its maximum displacement from its equilibrium position, which of the following becomes **zero**?

- (A) Its velocity and kinetic energy
- (B) Its velocity and potential energy
- (C) Its potential energy and kinetic energy
- (D) Its velocity and mechanical energy

Second: Essay

4) A vibrating source produces **600 complete vibrations** per minute. Calculate the ratio of its frequency to its periodic time.

Group (C)

First: Multiple Choice

1) If the time taken by a vibrating body to perform one complete vibration is **0.1 s**, then the number of complete vibrations produced by this body during a time interval of **4.5 s** equals vibrations.

- (A) 4.5
- (B) 45
- (C) 0.45
- (D) 1/45

2) The ratio between the time of amplitude of a vibrating body and the time of one complete oscillation equals

- (A) $2/1$
- (B) $1/2$
- (C) $4/1$
- (D) $1/4$

3) If the number of vibrations of a tuning fork increases, so the frequency

- (A) Increases
- (B) Decreases
- (C) Does not change
- (D) Becomes zero

Second: Essay

4) If the time of amplitude of a vibrating source is **0.02 s**, calculate its frequency.

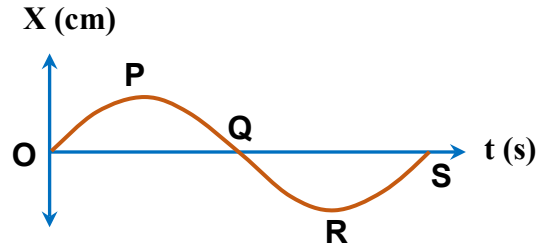
- The end -

**Chapter 2| Wave motion****First: Multiple Choice Questions**

- 1) A body of frequency **100 Hz** produces a wave that propagates in air with a speed of **320 m/s**. The wavelength of this wave is equal to
- (A) 3.2 m
(B) 0.3125 m
(C) 32000 m
(D) 420 m
-
- 2) Two sound waves of frequencies **256 Hz** and **512 Hz** propagate in the same medium. The ratio of their speeds is
- (A) 2 : 1
(B) 1 : 1
(C) 1 : 2
(D) 3 : 1
-
- 3) A sound wave is transmitted from air to iron. If the ratio between the speed of sound in air and its speed in iron is **3 : 44**, and the wavelength of the sound wave in air is **57.6 cm**, then the wavelength of the sound wave in iron is equal to
- (A) 4.9 cm
(B) 172.8 cm
(C) 533.5 cm
(D) 844.8 cm

- 4) The given curve represents a wave of frequency **2.5 Hz**. The time interval between **O** and **R** is seconds.

- (A) 0.1
(B) 0.2
(C) 0.3
(D) 0.4

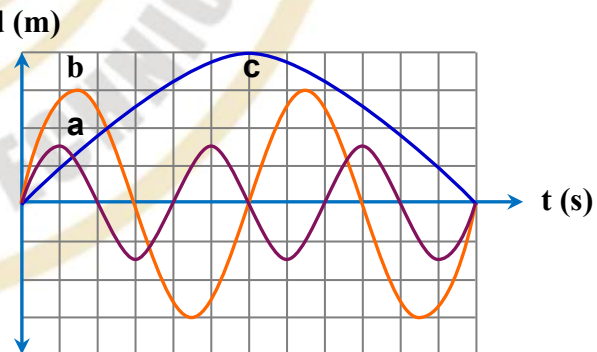


- 5) In a transverse wave, the direction of vibration of the particles of the medium relative to the direction of wave propagation is

- (A) In the same direction
(B) Perpendicular to it
(C) Inclined to it
(D) Variable

- 6) The opposite graph represents the relation between the displacement of a vibrating body (**d**) and time (**t**) for three vibrating sources (**a**, **b**, **c**). The source (**c**) has

- (A) The smallest amplitude and the lowest frequency
(B) The greatest amplitude and the highest frequency
(C) The smallest amplitude and the highest frequency
(D) The greatest amplitude and the lowest frequency



7) From the relation: $\lambda = \frac{v}{0.04}$

If the distance between a crest and the next trough is **2 m**, then the wave speed is

- (A) 0.08 m/s
- (B) 0.16 m/s
- (C) 320 m/s
- (D) 0.1 m/s

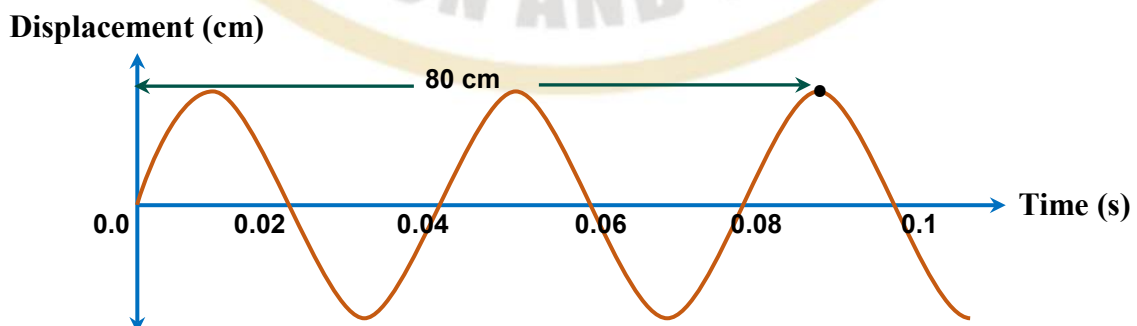
8) A sound source produces **60 vibrations** in **1.5 s**, and the resulting wave propagates in air with a speed of **340 m/s**. The distance between the centers of two successive compressions and rarefactions is equal to

- (A) 2.8 m
- (B) 4.25 m
- (C) 5.67 m
- (D) 8.5 m

Second: Essay Questions

9) The opposite figure shows the relation between the displacement (in centimeters) and time (in seconds) of a wave. Calculate the value of each of the following:

- (a) The wavelength
- (b) The speed of propagation of this wave



10) The opposite figure shows the relation between the displacement (in centimeters) and time (in ms) of a wave.

Find: a) Periodic time

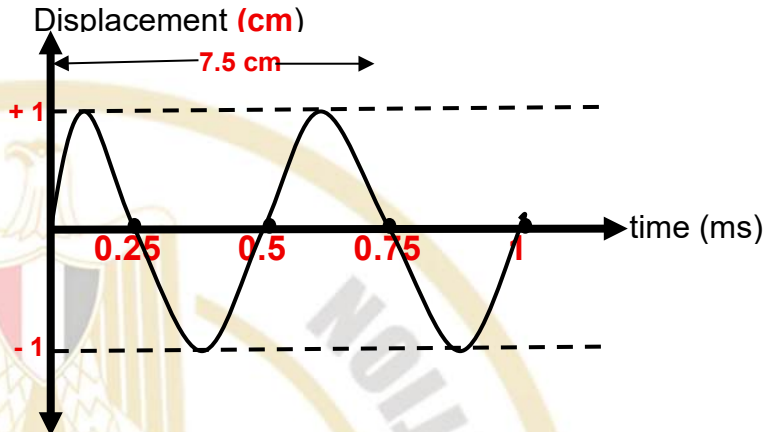
b) Frequency

c) No. of crests in 2 sec.

d) Wavelength

e) Velocity

f) Amplitude



- The end -

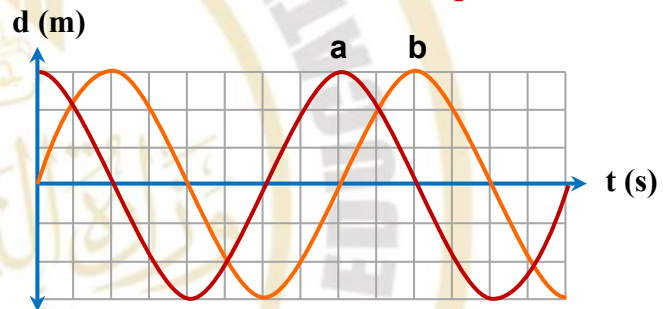
First: Multiple Choice Questions

1- If the time interval between the first crest and the tenth crest in a wave motion is 0.2 sec., then the frequency is

- a) 55 Hz b) 50 Hz c) 45 Hz d) 40 Hz

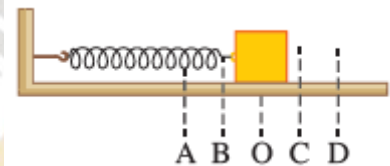
2- The opposite graph shows the relation between displacement (d) and time (t) for two vibrating bodies. The phase difference between the two vibration sources is equal to ..

- (A) Zero
(B) 0.25λ
(C) 0.5λ
(D) λ



3) The adjacent figure represents an object attached to a spring oscillating between the two points A, D, so the lowest value of the potential energy of the object is at

- a) Point A or point D
b) Point O only
c) Point B only
d) Point C only





Second: Essay Questions

4) Waves propagate on the surface of water with a speed of **5 m/s**.

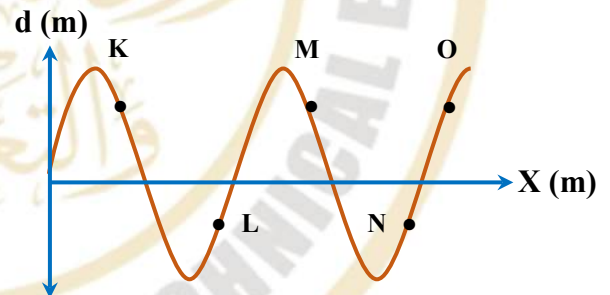
Calculate the number of waves present in a distance of 100 m, if their frequency is **0.4 Hz**.

Group (B)

First: Multiple Choice Questions

1) In the opposite figure, which of the following points is in the same phase as point **M**?

- (A) O
- (B) K
- (C) L
- (D) M



2) Two sound waves of frequencies **128 Hz** and **320 Hz** propagate in air with a speed of **320 m/s**.

The difference between their wavelengths is equal to

- | | |
|-----------|-----------|
| (A) 1.3 m | (B) 1.4 m |
| (C) 1.5 m | (D) 1.6 m |



- 3) When a rod vibrates **four times** per second, a wave crest travels a distance of **4 cm** in water. so the speed of propagation of the water waves is
- (A) 16 cm/s
(B) 24 cm/s
(C) 32 cm/s
(D) 40 cm/s

Second: Essay Questions

- 4) Waves propagate on the surface of water with a speed of **10 m/s**.
Calculate the number of waves present in a distance of **200 m**, if the periodic time of the wave is **0.05 s**.

Group (C)

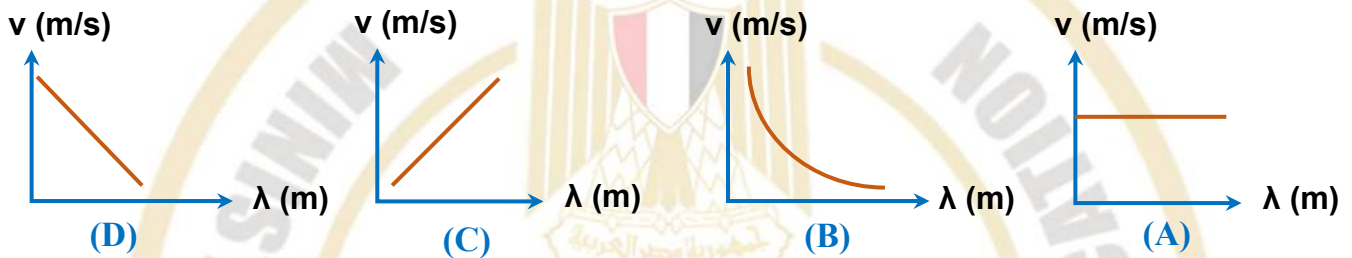
First: Multiple Choice Questions

- 1) If the ratio between the frequency of a man's voice and the frequency of a girl's voice is **3 : 4**, then the ratio between the speed of the man's voice and the speed of the girl's voice in air is equal to
- (A) 3 : 4
(B) 4 : 3
(C) 1 : 1
(D) 9 : 16

2) A stone is thrown in a pool, 40 waves are produced in 4 sec, and the diameter of the outer wave is 3.2 meter. so the speed of wave equals

- a) 0.2 m/s b) 0.4 m/s
c) 0.6 m/s d) 0.8 m/s

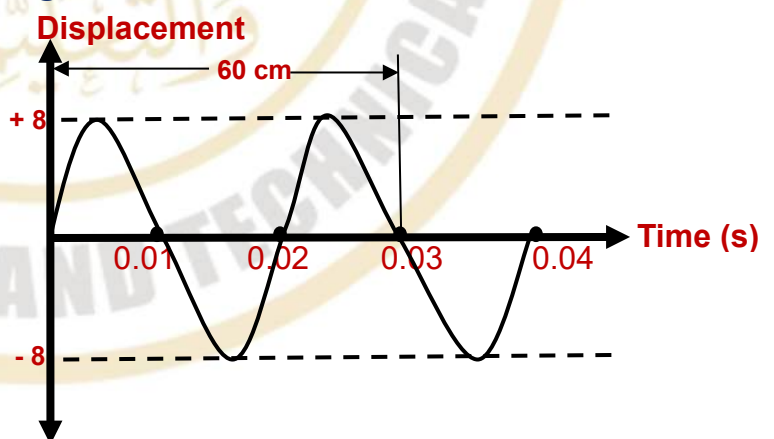
3) Which of the following graphs represents the relation between the wavelength and the wave propagation speed for a number of waves propagating in the same medium?



Second: Essav Questions

4) The opposite graph shows the relation between the displacement of a vibrating body d (cm), and time t (s). Calculate the following:

1. The amplitude of vibration
2. The frequency of vibration
- 3- Wavelength
- 4-Periodic time
- 5- Wave speed

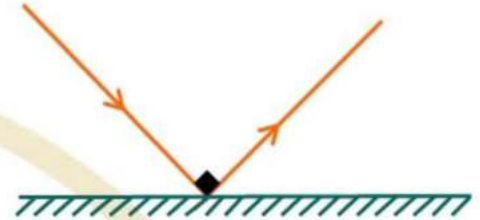


- The end -

Chapter 3| Light reflection and refraction**First: Multiple Choice Questions**

(1) In the shown figure, the angle of reflection of the light ray from the mirror is

- (a) 0°
- (b) 45°
- (c) 90°
- (d) 135°

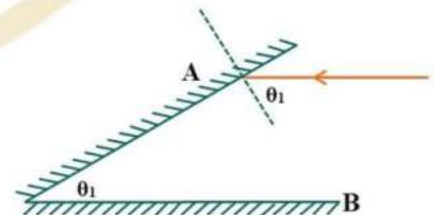


(2) If the angle between two mirrors is a right angle (90°), and a light ray (X) falls on one of the mirrors at an angle (θ not equal zero), then the light ray reflected from the other mirror reflects

- (a) Parallel to ray (X)
- (b) Perpendicular to ray (X)
- (c) At an angle (θ)
- (d) Back onto itself

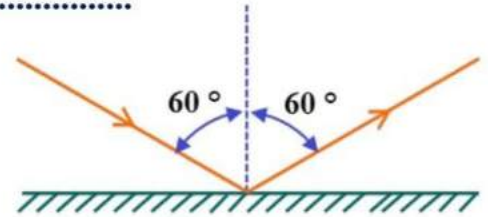
(3) In the shown figure, if the angle of incidence of the light ray on mirror A is equal to the angle between the two mirrors, then the light ray falls on mirror B at an angle =

- (a) 0°
- (b) 30°
- (c) 60°
- (d) 90°



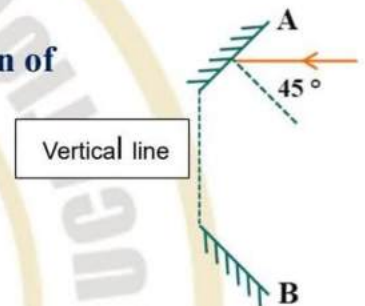
(4) In the figure shown, if the angle of incidence of the light ray decreases by 10° , then the reflected light ray rotates by an angle of

- (a) 10° , clockwise.
- (b) 20° , clockwise.
- (c) 10° , counter-clockwise.
- (d) 20° , counter-clockwise.



(5) In the figure shown, if each of the two mirrors is inclined to the horizontal by an angle of 45° , the angle of reflection of the light ray from mirror B =

- (a) 0°
- (b) 45°
- (c) 90°
- (d) 180°



(6) A student noticed that a pencil in a cup appears broken; this is due to the difference in

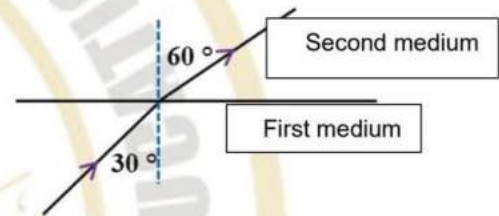
- (a) The perpendicularity of light in the two media.
- (b) The frequency of light through the two media.
- (c) The intensity of light in the two media.
- (d) The optical density of the two media.



- (7) A light ray falls on the interface between air and another transparent medium, and its speed decreases by one-third. Therefore, the absolute refractive index of the medium =
- (a) 0 (b) 1.5 (c) 1.33 (d) 1.66

- (8) The following figure representing the path of light through two transparent media. The ratio between the periodic time of light in the first medium to the periodic time in the second medium is

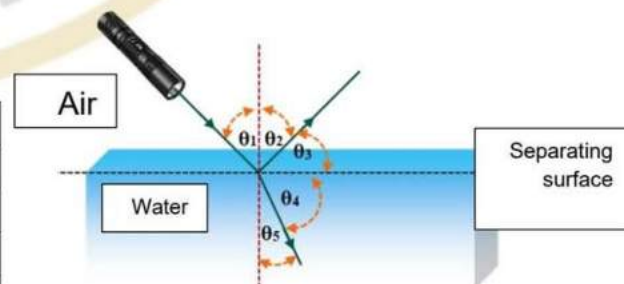
- (a) $\frac{\sqrt{3}}{3}$ (b) $\sqrt{3}$
(c) $\frac{1}{2}$ (d) $\frac{1}{1}$



Second: Essay Questions

- (1) The figure shows a light ray falling on the interface between air and water. What happens to the magnitude of each of the angles shown in the figure? (Increases, decreases, or remains constant) when the angle of incidence is decreased?

Angle	What happens to its magnitude?
θ_2	
θ_3	
θ_4	
θ_5	



(2) A person stands in a brightly lit room and looks through the window glass. Will the person see their own reflection or see the image of the tree if it is daylight outside the room?



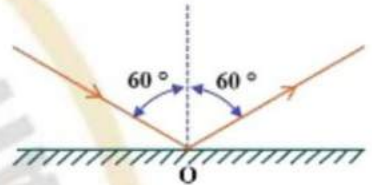
(3) When light travels from air to transparent medium, its speed decreases by 25%. Calculate the absolute refractive index of the glass.

- The end -

Group (A)**First: Multiple Choice Questions**

1- If the mirror rotates around point (O) by an angle of 10° clockwise, the reflected light ray will rotate by.....

- a) 0°
- b) 5°
- c) 10°
- d) 20°

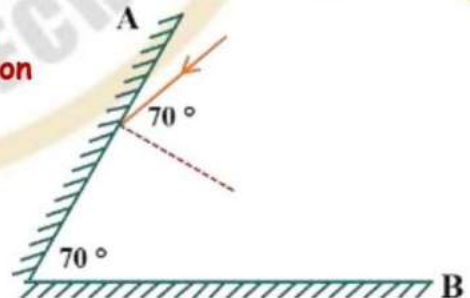


2-The ratio between the angle of incidence of a light ray passing in glass (refractive index = 1.5) to the angle of its refraction in water (refractive index = 1.33) is

- a) Less than 1
- b) Greater than 1
- c) Equal to 1
- d) 1.5

3-In the figure shown, the value of the angle of reflection of the light ray from mirror B =

- a) 0°
- b) 20°
- c) 35°
- d) 45°





Second: Essay Questions

You know that the speed of light in a vacuum equals 2.99792458×10^8 m/s, and its speed in air is less by approximately 90 km/s:

Calculate the absolute refractive index of air.

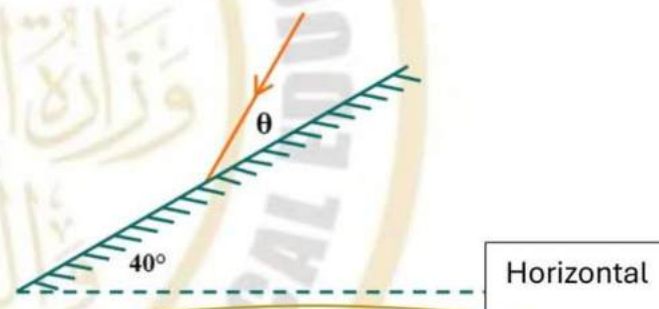
Can its value be considered equal to one?

Group (B)

First: Multiple Choice Questions

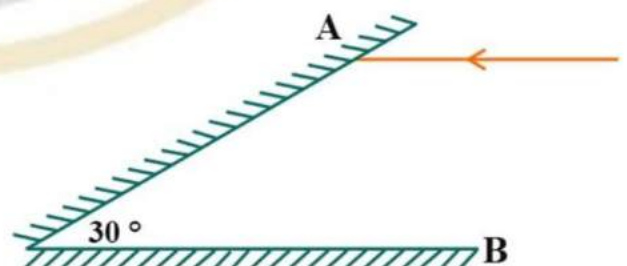
1-The figure shows a mirror tilted from the horizontal by an angle of 30° (noting the diagram indicates 40°). If a light ray falls on the mirror such that the reflected ray is parallel to the horizontal, then the angle of reflection equals.....

- a) 20°
- b) 40°
- c) 60°
- d) 50°



2-In the figure shown, if the incident light ray is parallel to mirror B, calculate the value of the angle of reflection of the light ray from mirror B..... =

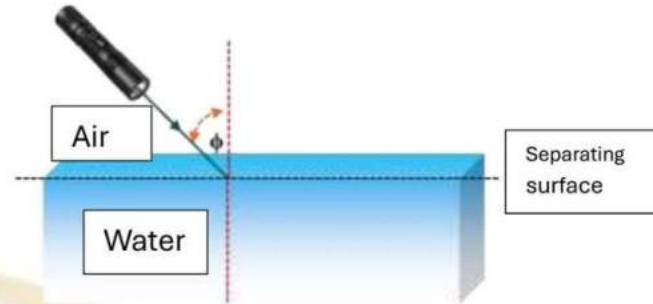
- a) 0°
- b) 30°
- c) 60°
- d) 90°





3-A light ray falls from air into water as shown in the figure; its periodic time.....

- a) Increases
- b) Decreases
- c) Remains unchanged
- d) Cannot be determined



Second: Essay Questions

When light travels from air to water, its speed decreases by one-third, and when it travels from air to glass, its speed decreases by 25%. What is the decrease in its speed when it travels from water to glass?

Group (C)

First: Multiple Choice Questions

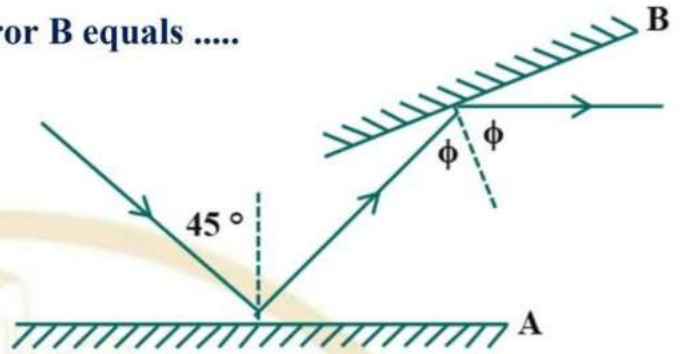
1-A light ray travels between two transparent media of different optical densities at a non-zero angle of incidence. If you know that the ratio between the wavelength of light in the first medium to its wavelength in the second medium equals $\frac{3}{2}$, then the light ray is expected to

- a) Undergo total internal reflection
- b) Refract away from the normal
- c) Refract toward the normal
- d) Pass through without undergoing any refraction



2) In the figure shown, a light ray falls on a horizontal mirror A at an angle of 45° , then reflects to fall on mirror B. The reflected ray from mirror B is parallel to mirror A. Therefore, the angle of incidence on mirror B equals

- a) 22.5°
- b) 45°
- c) 67.5°
- d) 76.5°



3) The ratio between the sine of the angle of incidence for a light ray passing through glass (refractive index 1.5) and the sine of the angle of refraction in water (refractive index 1.33) equals

- a) Less than 1
- b) Greater than 1
- c) Equal to 1
- d) 1.5

Second: Essay Questions

If you know that the speed of light in air = 3×10^8 m/s, and the refractive indices of alcohol and glass are 1.47 and 1.5 respectively, find:

- a) The speed of light in alcohol.
- b) The speed of light in glass.
- c) The relative refractive index from alcohol to glass.
- d) The relative refractive index from glass to alcohol.

-The end-



Week (1)

Homework (1)

Choose the correct answer

D	(6)	A	(5)	C	(4)	C	(3)	B	(2)	B	(1)
C	(12)	B	(11)	C	(10)	D	(9)	D	(8)	C	(7)

Essay questions

13) Work is a scalar quantity because it is the dot product of two vector quantities (force and displacement)

$$14- w = mg d \cos \theta = 40 \times 10 \times 20 \times \cos 60 = 4000 J$$

$$15) w = F \cdot d \cos \theta$$

$$2.5 \times 10^5 = F \times 10^3 \cos 60 \rightarrow F = 500 N$$

Weekly Assessment [1]

Group (A)

First: Choose the correct answer:

C	(4)	C	(3)	D	(2)	A	(1)
---	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

$$w = F \cdot d = mgd = 300 \times 10^{-3} \times 10 \times 10 \times 10^{-2} = 0.3 J (5)$$

Group (B)

First: Choose the correct answer:

C	(4)	D	(3)	C	(2)	C	(1)
---	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

$$w = F \cdot d \cos \theta \quad 100 = F \cdot 20 \cos 60 \rightarrow F = 10 N (5)$$

Group (C)

First: Choose the correct answer:

A	(4)	C	(3)	A	(2)	A	(1)
---	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

$$w = F \cdot d \cos \theta = 50 \times 4 \times \cos 60 = 100 J (5)$$



Week 2

Homework [2]

First: Choose the correct answer:

D	(6)	A	(5)	C	(4)	C	(3)	B	(2)	D	(1)
D	(12)	B	(11)	D	(10)	C	(9)	D	(8)	B	(7)

Second: Essay Questions:

$$(PE)_A = (PE)_B \rightarrow (wh)_A = (wh)_B \quad (13)$$
$$\therefore 40 \times h_A = 60 \times 2 \rightarrow h_A = 3m \quad (14)$$

$$w = F \cdot d = mg d \cos \theta = 70 \times 9.8 \times 6 \cos 60 = 2058 J$$

$$h = 6 \sin 30 = 3 m$$

$$PE = mgh = 70 \times 9.8 \times 3 = 2058 J$$

We conclude that the work done by the man is equal to the man's potential energy at the top of the ladder.

Weekly Assessment [2]

Group (A)

First: Choose the correct answer:

D	(4)	D	(3)	B	(2)	C	(1)
---	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

$$w = mgh = 50 \times 10 \times 2.2 = 1100 J \quad (5)$$

Group (B)

First: Choose the correct answer:

12 KE	(4)	D	(3)	D	(2)	A	(1)
-------	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

$$PE = mgh = 2 \times 9.8 \times 0.5 = 9.8 J$$

Group (C)

First: Choose the correct answer:

D, B	(4)	D	(3)	D	(2)	C	(1)
------	-----	---	-----	---	-----	---	-----

Second: Essay Questions:

5) Variable speed because the kinetic energy changes (increases).

$$KE \propto v^2, KE = \frac{1}{2} mv^2$$



Week 3

Homework [3]

First: Choose the correct answer:

C	(4)	B	(3)	B	(2)	C	(1)
B	(8)	A	(7)	B	(6)	D	(5)

Second: Essay Questions:

$$PE = KE \rightarrow mgh = \frac{1}{2}mv^2 \rightarrow 500 \times 10 \times 30 = \frac{1}{2} \times 500 \times v^2 \rightarrow v = 24.49 \text{ m/s (9)}$$

$$PE = mgh = wh = 500 \times 10 = 5000 \text{ J A (10)}$$

$$PE = 0 \quad \text{B}$$

$$E = PE_{\text{max height}} = 5000 \text{ J C}$$

Weekly Assessment [3]

Group (A)

First: Choose the correct answer:

C	(3)	B	(2)	C	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

$$2 \text{ (3)} \quad 1 \text{ (2)} \quad 3 \text{ (1)} \quad (4)$$

Group (B)

First: Choose the correct answer:

B	(3)	A	(2)	C	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

: A at point 4)

$$PE = \text{max} , KE = 0 , E = PE = \text{max}$$

: B at point

$$PE = 0 , KE = \text{max} , E = KE = \text{max}$$

Group (C)

First: Choose the correct answer:

B	(3)	D	(2)	D	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

$$ME = PE_{\text{max height}} = mgh = 4 \times 2 \times 10 = 80 \text{ J (4)}$$

$$ME = PE + KE \rightarrow 80 = (2 \times 10 \times h) + \left(\frac{1}{2} \times 2 \times 25 \right) \rightarrow h = 2.75 \text{ m}$$



Week 4

Homework [4]

First: Choose the correct answer:

B	(4)	D	(3)	B	(2)	D	(1)
C	(8)	B	(7)	A	(6)	C	(5)

Second: Essay Questions:

$$v = \frac{N}{t} = \frac{0.5}{0.1} = 5 \text{ Hz} \quad (9)$$

$$v = \frac{N}{t} = \frac{1}{4 \times 10^{-3}} = 250 \text{ Hz} \quad (10)$$

Weekly Assessment [4]

Group (A)

First: Choose the correct answer:

A	(3)	A	(2)	B	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

(4)

$$v = \frac{N}{t} = \frac{1200}{60} = 20 \text{ Hz}$$

Group (B)

First: Choose the correct answer:

A	(3)	A	(2)	B	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

$$v = \frac{N}{t} = \frac{600}{60} = 10 \text{ Hz} , \quad T = 0.1 \text{ S} \rightarrow \frac{v}{T} = \frac{10}{0.1} = 100 \text{ S}^{-2} \quad (4)$$

Group (C)

First: Choose the correct answer:

C	(3)	D	(2)	B	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

(4)

$$v = \frac{N}{t} = \frac{0.25}{0.02} = 12.5 \text{ Hz}$$



Week 5

Homework [5]

First: Choose the correct answer:

C	(4)	D	(3)	B	(2)	A	(1)
B	(8)	B	(7)	D	(6)	B	(5)

Second: Subjective (Essay) Questions:

$$\lambda = \frac{x}{n} = \frac{80}{2.25} = 35.5 \text{ cm} = 0.355 \text{ m} \quad A(9)$$
$$v = \frac{N}{t} = \frac{0.5}{0.02} = 25 \text{ Hz} \rightarrow v = \lambda \cdot v = 0.355 \times 25 = 8.88 \text{ m B}$$

(10)

$$T = \frac{t}{N} = \frac{0.25 \times 10^{-3}}{0.5} = 5 \times 10^{-4} \text{ s} -1$$

$$v = \frac{N}{t} = \frac{0.5}{0.25 \times 10^{-3}} = 2000 \text{ Hz} -2$$

$$N = \frac{t}{T} = \frac{2}{0.5 \times 10^{-3}} = 4000 \text{ قمة} -3$$

$$\lambda = \frac{x}{n} = \frac{7.5}{1.5} = 5 \text{ cm} = 0.05 \text{ m} -4$$

$$v = \lambda \cdot v = 0.05 \times 2000 = 100 \text{ m/s} -5$$

1 cm -6

Weekly Assessment [5]

Group (A)

First: Choose the correct answer:

B	(3)	B	(2)	C	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

$$t = \frac{x}{v} = \frac{100}{5} = 20 \text{ s} \rightarrow N = v \cdot t = 0.4 \times 20 = 8 \text{ wave}$$

(4)

Group (B)

First: Choose the correct answer:

A	(3)	C	(2)	A	(1)
---	-----	---	-----	---	-----

Second: Essay Questions:

$$t = \frac{x}{v} = \frac{200}{10} = 20 \text{ s} \rightarrow N = \frac{t}{T} = \frac{20}{0.05} = 400 \text{ oscillation}$$

(4)

Group (C)

First: Choose the correct answer:

A	(3)	B	(2)	C	(1)
---	-----	---	-----	---	-----



Second: Essay Questions:

(4

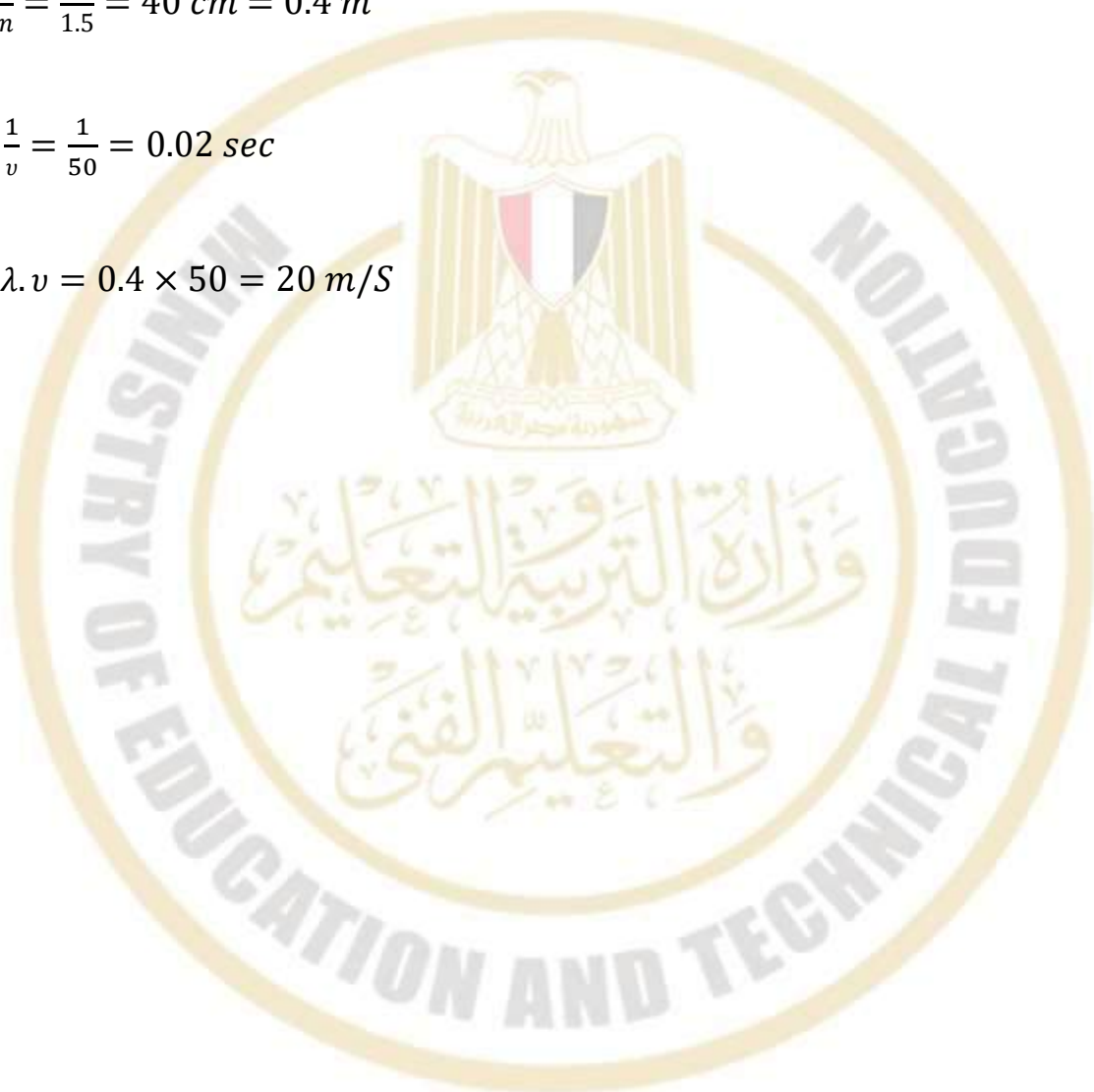
1) 8 cm

2) $v = \frac{N}{t} = \frac{0.5}{0.01} = 50 \text{ Hz}$

3) $\lambda = \frac{x}{n} = \frac{60}{1.5} = 40 \text{ cm} = 0.4 \text{ m}$

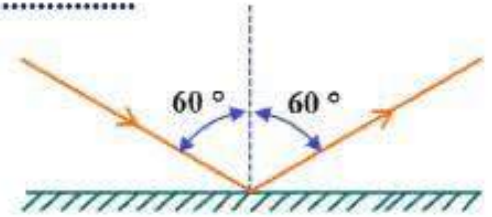
4) $T = \frac{1}{v} = \frac{1}{50} = 0.02 \text{ sec}$

5) $v = \lambda \cdot v = 0.4 \times 50 = 20 \text{ m/S}$



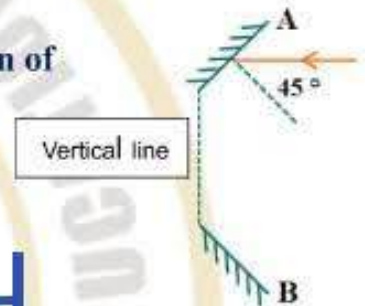
(4) In the figure shown, if the angle of incidence of the light ray decreases by 10° , then the reflected light ray rotates by an angle of

- (a) 10° , clockwise.
- (b) 20° , clockwise.
- ☒ (c) 10° , counter-clockwise.
- (d) 20° , counter-clockwise.



(5) In the figure shown, if each of the two mirrors is inclined to the horizontal by an angle of 45° , the angle of reflection of the light ray from mirror B =

- (a) 0°
- ☒ (b) 45°
- (c) 90°
- (d) 180°



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(6) A student noticed that a pencil in a cup appears broken; this is due to the difference in

- (a) The perpendicularity of light in the two media.
- (b) The frequency of light through the two media.
- (c) The intensity of light in the two media.
- ☒ (d) The optical density of the two media.





(2) A person stands in a brightly lit room and looks through the window glass. Will the person see their own reflection or see the image of the tree if it is daylight outside the room?

image of the tree



(3) When light travels from air to transparent medium, its speed decreases by 25%. Calculate the absolute refractive index of the glass.

$$v_1 = 1 \quad v_2 = 0.75$$

$$n = v_1 / v_2 = 1 / 0.75 = 1.33$$

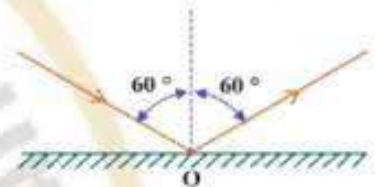
- The end -

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First: Multiple Choice Questions

1- If the mirror rotates around point (O) by an angle of 10° clockwise, the reflected light ray will rotate by.....

- a) 0°
- b) 5°
- c) 10°
- ☒ d) 20°



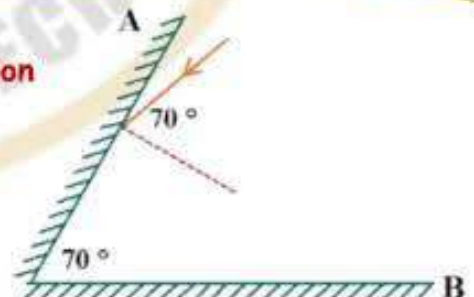
2-The ratio between the angle of incidence of a light ray passing in glass (refractive index = 1.5) to the angle of its refraction in water (refractive index = 1.33) is

- ☒ a) Less than 1
- b) Greater than 1
- c) Equal to 1
- d) 1.5

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3-In the figure shown, the value of the angle of reflection of the light ray from mirror B =

- ☒ a) 0°
- b) 20°
- c) 35°
- d) 45°





Second: Essay Questions

You know that the speed of light in a vacuum equals 2.99792458×10^8 m/s, and its speed in air is less by approximately 90 km/s:

Calculate the absolute refractive index of air.

Can its value be considered equal to one?

$$n = c/v = 1.003$$

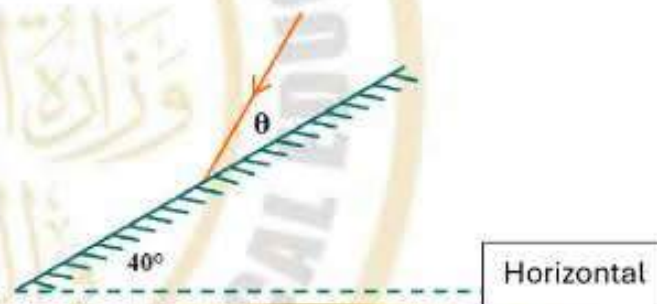
consider equal one

Group (B)

First: Multiple Choice Questions

1-The figure shows a mirror tilted from the horizontal by an angle of 30° (noting the diagram indicates 40°). If a light ray falls on the mirror such that the reflected ray is parallel to the horizontal, then the angle of reflection equals.....

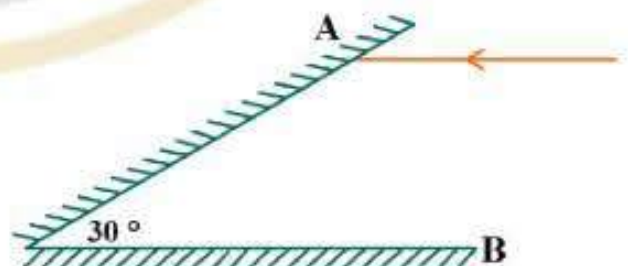
- a) 20°
- b) 40°
- c) 60°
- ☒ d) 50°



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2-In the figure shown, if the incident light ray is parallel to mirror B, calculate the value of the angle of reflection of the light ray from mirror B..... =

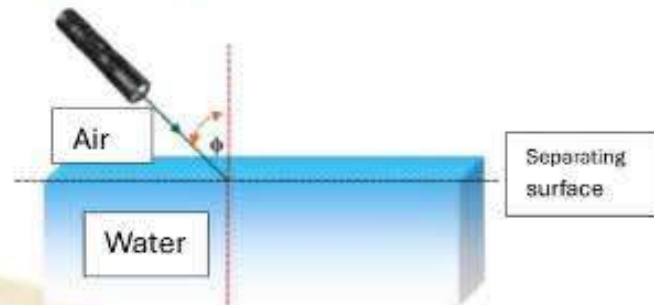
- a) 0°
- ☒ b) 30°
- c) 60°
- d) 90°





3-A light ray falls from air into water as shown in the figure; its periodic time.....

- a) Increases
- b) Decreases
- ☒ c) Remains unchanged
- d) Cannot be determined



Second: Essay Questions

When light travels from air to water, its speed decreases by one-third, and when it travels from air to glass, its speed decreases by 25%. What is the decrease in its speed when it travels from water to glass?

$$n_{\text{glass}} = c/v = 1/2/3 = 1.5$$

$$n_{\text{water}} = c/v = 1/0.75 = 4/3$$

$$n_{\text{glass}} / n_{\text{water}} = v_{\text{water}} / v_{\text{glass}} \\ = 9/8$$

$$v_{\text{glass}} = 8/9 v_{\text{water}}$$

$$\text{decrease in speed} = 1 - 8/9 = 1/9$$

Group (C)

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First: Multiple Choice Questions

1-A light ray travels between two transparent media of different optical densities at a non-zero angle of incidence. If you know that the ratio between the wavelength of light in the first medium to its wavelength in the second medium equals $3/2$, then the light ray is expected to

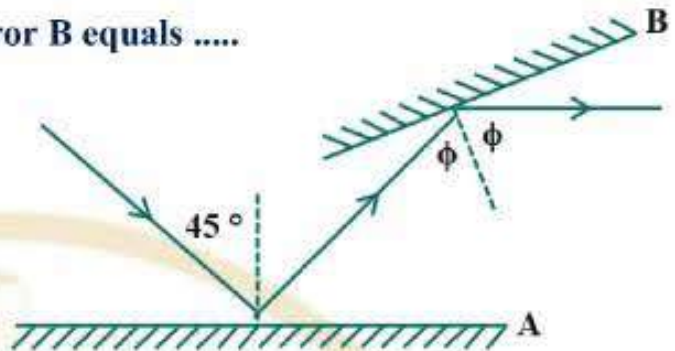
- a) Undergo total internal reflection
- b) Refract away from the normal
- ☒ c) Refract toward the normal
- d) Pass through without undergoing any refraction

$$\text{wavelength } 2 / \text{wavelength } 1 = n_1 / n_2 \\ = 2/3$$



2) In the figure shown, a light ray falls on a horizontal mirror A at an angle of 45° , then reflects to fall on mirror B. The reflected ray from mirror B is parallel to mirror A. Therefore, the angle of incidence on mirror B equals

- a) 22.5°
- b) 45°
- ☒ c) 67.5°
- d) 76.5°



3) The ratio between the sine of the angle of incidence for a light ray passing through glass (refractive index 1.5) and the sine of the angle of refraction in water (refractive index 1.33) equals

- ☒ a) Less than 1
- b) Greater than 1
- c) Equal to 1
- d) 1.5

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Second: Essay Questions

If you know that the speed of light in air = 3×10^8 m/s, and the refractive indices of alcohol and glass are 1.47 and 1.5 respectively, find:

- a) The speed of light in alcohol.
- b) The speed of light in glass.
- c) The relative refractive index from alcohol to glass.
- d) The relative refractive index from glass to alcohol.

a- $n_{\text{alcohol}} / n_{\text{air}} = v_{\text{air}} / v_{\text{alcohol}}$

$1.47 / 1 = 3 \times 10^8 / v_{\text{alcohol}}$

$v_{\text{alcohol}} = 2.040 \times 10^8 \text{ m/s}$

b- $1 - n_{\text{glass}} / n_{\text{air}} = v_{\text{air}} / v_{\text{glass}}$

$1.5 / 1 = 3 \times 10^8 / v_{\text{glass}}$

$v_{\text{glass}} = 2 \times 10^8 \text{ m/s}$

c - $= n_{\text{glass}} / n_{\text{alcohol}}$
 $= 1.5 / 1.47 = 1.02$

d - $= n_{\text{alcohol}} / n_{\text{glass}}$

-The end- $= 1.47 / 1.5 = 0.98$

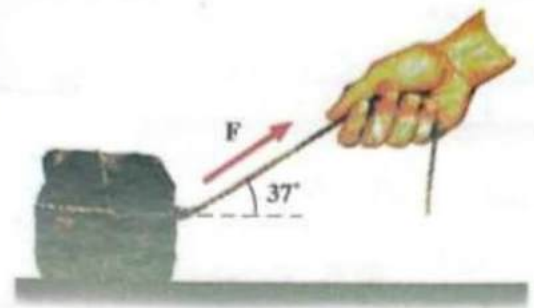
Model Exam (1) - March 2026

Grade: Second Secondary

First: Multiple Choice Questions

1-A person pulls a box on the ground at a constant speed using a force F as shown in the figure. If the friction force opposing the motion is 20 N and the mass of the box is 30 kg, then the magnitude of force F and the work done by force F on the box when it moves a distance of 5 m are respectively:

- a) 20 N — 100 J
- b) 0 N — 0 J
- c) 25 N — 125 J
- d) 25 N — 100 J



2- A man lifts a bucket weighing 200 N. If the work done to lift the bucket to the opening of a well is 8 kJ, then the depth of the well equals.....

- a) 0.04 m
- b) 40 m
- c) 4 m
- d) 400 m

3-An object with a mass of 2 kg falls freely from rest from a height of 80 m. Its kinetic energy after falling a distance of 25 m equals: ($g = 10 \text{ m/s}^2$)

- | | |
|-----------|----------|
| a) 1000 J | b) 500 J |
| c) 1100 J | d) 600 J |



4-A ball fell to the ground from a height of 5 m. Using energy concepts, the speed of the ball just before it hits the ground (ignoring air resistance) equals.....

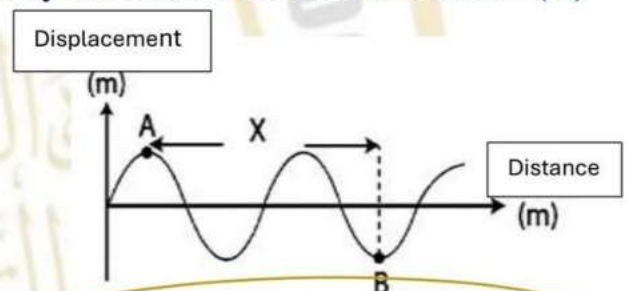
- a) 5 m/s
- b) 50 m/s
- c) 10 m/s
- d) 20 m/s

5- An oscillating body takes a time period of 0.04 s to reach its maximum displacement away from its original equilibrium position; therefore, its frequency equals:

- a) 25 Hz
- b) 31.25 Hz
- c) 6.25 Hz
- d) 20 Hz

6-For a transverse wave with speed 10 m/s and frequency 2.5 Hz, the horizontal distance (X) between points A and B is:

- a) 4 m
- b) 5 m
- c) 6 m
- d) 7 m



7-Frequency is numerically greater than the periodic time by 3.75 when the periodic time equals

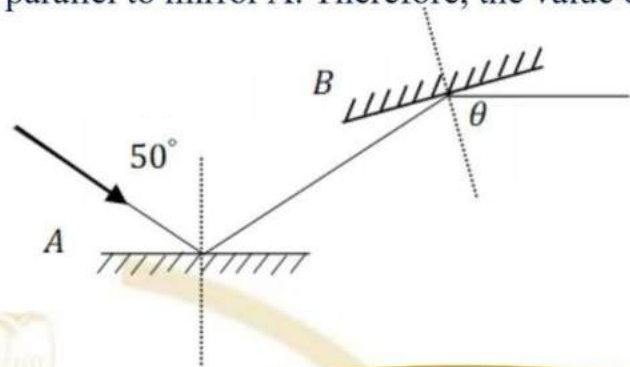
- a) 2 s
- b) 1/2 s
- c) 1/4 s
- d) 4 s

8-If the frequency of a second wave is less than the first by one-fourth, the wavelength of the second:

- a) Increases by 25%
- b) Increases by 33%
- c) Decreases by 33%
- d) Decreases by 25%

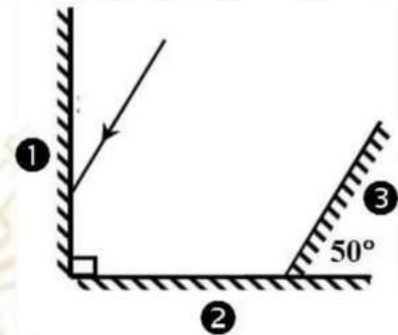
9-A light ray falls on horizontal mirror A at an angle of 50° as shown. It reflects to fall on mirror B and reflects from it in a direction parallel to mirror A. Therefore, the value of θ is:

- a) 40°
- b) 50°
- c) 60°
- d) 70°



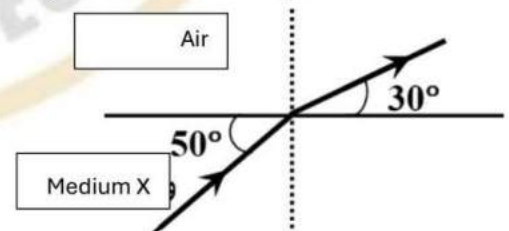
10-In the figure, three mirrors. In which (1) and (2) are perpendicular while mirror (3) makes an angle of 50° with mirror (2). If a ray falls on mirror (1) parallel to mirror (3), it will fall on mirror (2) at an angle of:

- a) 30°
- b) 40°
- c) 50°
- d) 60°



11-In the figure shown, the speed of light in medium X equals ($c = 3 \times 10^8$ m/s):

- a) 2.7×10^8 m/s
- b) 4.04×10^8 m/s
- c) 1.92×10^8 m/s
- d) 2.23×10^8 m/s



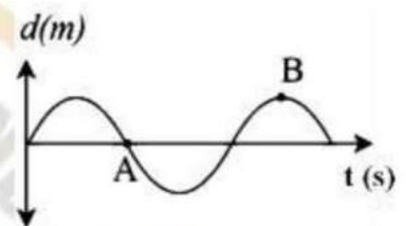


12- When the angle of incidence changes from 80° to 40° , the angle of refraction will change from 40° to:

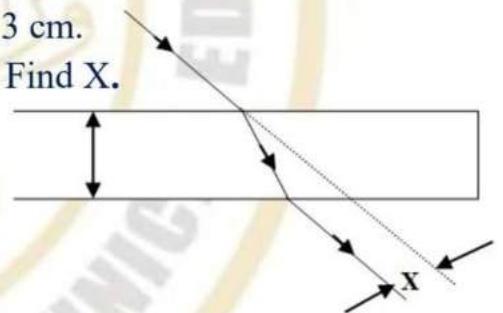
- a) 22.5°
- b) 24.8°
- c) 20°
- d) 30°

Second: Essay Questions

1-The curve represents a wave with a frequency of 25 Hz.
Calculate the time interval between points A and B.



2- In the figure, a light ray falls at an angle of 45° from air onto one side of a parallel-sided glass plate with a refractive index of $\sqrt{2}$ and a thickness of 3 cm.
The ray exits shifted from its original path by a distance X. Find X.



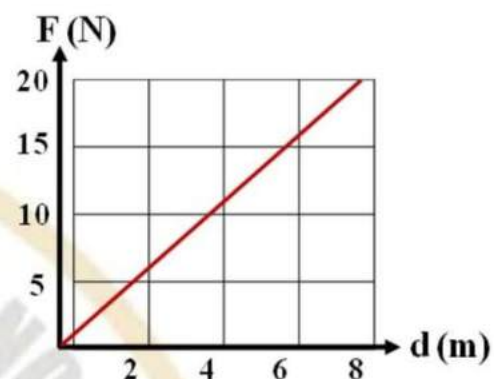
3-An oscillating body completes a full oscillation every 0.04 s. The sound reaches a person 216 m away 0.6 s after it occurs. Calculate the distance between the center of the second compression and the center of the fifth compression.

Model Exam (2) - March 2026

Grade: Second Secondary

First: Multiple Choice Questions

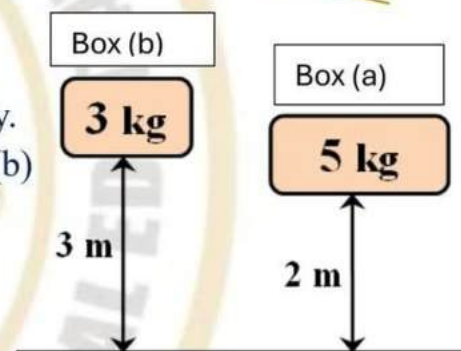
1. The following graph represents the relationship between the force acting on an object and the displacement it moves in the direction of the force. The total work done by this force equals:
- (a) 2.5 J (b) 40 J (c) 80 J (d) 160 J



2. Two boxes, (a) and (b), have masses of 5 kg and 3 kg respectively. Box (a) is placed at a height of 2 m from the ground, while box (b) is at a height of 3 m.

To make the potential energy of box (a) equal to $\frac{2}{3}$ of the potential energy of box (b), box (b) must be moved by:

- (a) 1.5 m downwards (b) 2 m upwards
(c) 2.5 m downwards (d) 5 m upwards



3. An object moves horizontally at a constant speed under influence of a horizontal force (F) of 10 N. The object travels a distance of 5 m.

Which of the following statements is incorrect?

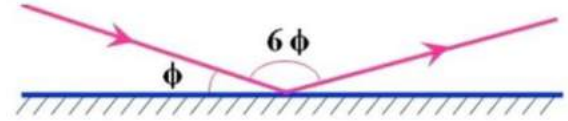
- (a) The work done by force (F) equals 50 J.
(b) The work done by the friction force equals -50 J.
(c) The work done by the force of gravity equals zero.
(d) The total work done by the horizontal forces equals 100 J.



4. If the potential energy of a free-falling object is calculated by the relationship $PE = 10h$, then the kinetic energy of the object when its speed reaches 6 m/s equals: ($g = 10 \text{ m/s}^2$)
(a) 3 J (b) 6 J (c) 18 J (d) 36 J
5. If the ratio between the frequency of an oscillating body and its periodic time is $49/4 \text{ s}^{-2}$, then the time required to complete 21 oscillations is
(a) 6 s (b) 7 s (c) 11 s (d) 21 s
6. The following graph shows the relationship between displacement (m) and time (sec.) for a transverse wave.
-
- So, the ratio between the distance between points A and B and the wave amplitude is:
(a) 5 (b) 10
(c) 17.5 (d) 35
7. In a transverse wave, the horizontal distance between a consecutive crest and trough is double the vertical distance between them. If the wave speed is 20 m/s and its frequency is 10 Hz, then the wave amplitude is:
(a) 0.25 m (b) 0.5 m (c) 1 m (d) 2 m

8- In the opposite figure, the angle of reflection equals.....

- (a) 22.5° (b) 30° (c) 45° (d) 67.5°



9- In the opposite figure. An incident ray falls on the mirror (A) then reflects on the mirror (B), then the mirror (C), so the angle of reflection from the mirror (C) equals

- a) 20° b) 40°
c) 50° d) 70°



10. A light ray passes at an angle from a medium with a refractive index of $n_1 = \frac{7}{6}$ to the interface of a medium with a refractive index of $n_2 = \frac{8}{7}$ Therefore:

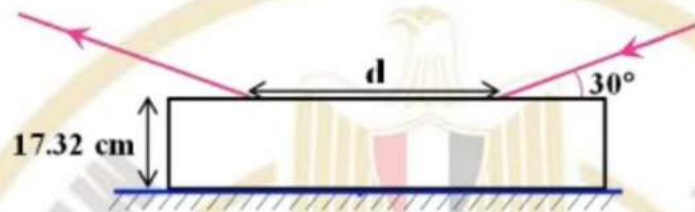
- (a) Its speed increases and it refracts toward the normal.
(b) Its speed decreases and it refracts away from the normal.
(c) Its speed decreases and it refracts toward the normal.
(d) Its speed increases and it refracts away from the normal.

11- A light ray falls on a glass surface with an angle of incidence of 40° and refracts at an angle of 30° . If the angle of incidence increases to double its value, the angle of refraction increases by:

- (a) 15° (b) 20° (c) 30° (d) 60°

12-The opposite figure shows a rectangular glass block with a thickness of 17.32 cm and a refractive index of $n = \sqrt{3}$, placed on a horizontal plane mirror. A light ray is incident on the upper surface making an angle of 30° with the surface. The ray is refracted, then reflected by the mirror, and finally emerges again from the upper surface at a distance (d) from the point of incidence. The value of d is equal to

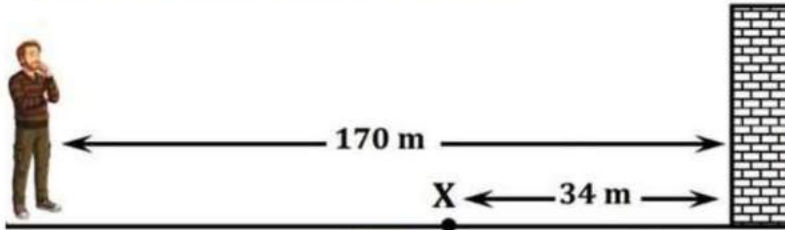
- A) 4.33 cm B) 10 cm C) 8.66 cm D) 20 cm



Second: Essay Questions

13. A man stands between two towers. He is 100 m away from one and 400 m away from the other. When he strikes a drum, he hears two sounds with a time interval of 2 s between them. Calculate the speed of sound in the air.

- 14-A person stands in a wide field facing a wall at a distance of 170 m. A gun was placed at point (X), which is 34 m away from the wall. A bullet was fired from the gun. Calculate the time interval between the two sounds heard by the person, knowing that the speed of sound in the air is 340 m/s.



- 15-Two sound waves are propagating in the air. The first has a frequency of 680 Hz, and the second has a frequency of (ν). If the wavelength of one of them exceeds the wavelength of the other by 50 cm, calculate the value of the frequency (ν)?
Note that the speed of sound in the air = 340 m/s.

-The end-

First: Multiple Choice Questions

$$\Sigma F = 0$$

$$F \cos 37^\circ = 20$$

$$F = 25 \text{ N}$$

1-A person pulls a box on the ground at a constant speed using a force F as shown in the figure. If the friction force opposing the motion is 20 N and the mass of the box is 30 kg, then the magnitude of force F and the work done by force F on the box when it moves a distance of 5 m are respectively:

a) 20 N — 100 J

~~b) 0 N — 0 J~~

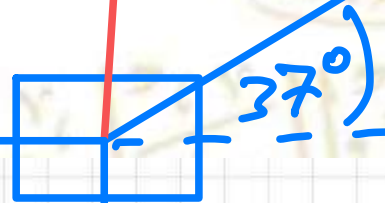
~~c) 25 N — 125 J~~

d) 25 N — 100 J

$$F_N + F \sin \theta$$

$$25$$

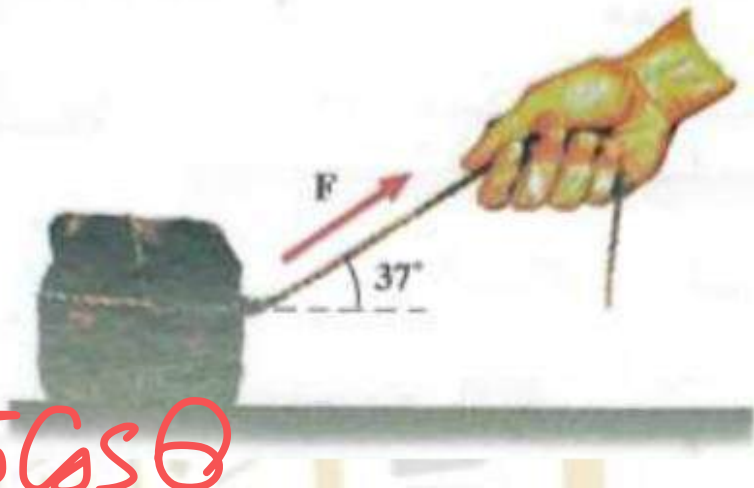
$$F_f = 20 \leftarrow$$



$$25 \cos \theta$$

$$W = F d \cos \theta$$

$$= 25 \times 5 \cos 37^\circ = 100 \text{ J}$$



2- A man lifts a bucket weighing 200 N. If the work done to lift the bucket to the opening of a well is 8 kJ, then the depth of the well equals.....

- a) 0.04 m
- b) 40 m
- c) 4 m
- d) 400 m

$$W = Fd$$

$$8 \times 10^3 = 200d$$

$$d = 40m$$

3-An object with a mass of 2 kg falls freely from rest from a height of 80 m. Its kinetic energy after falling a distance of 25 m equals: ($g = 10 \text{ m/s}^2$)

a) 1000 J

b) 500 J

c) 1100 J

d) 600 J

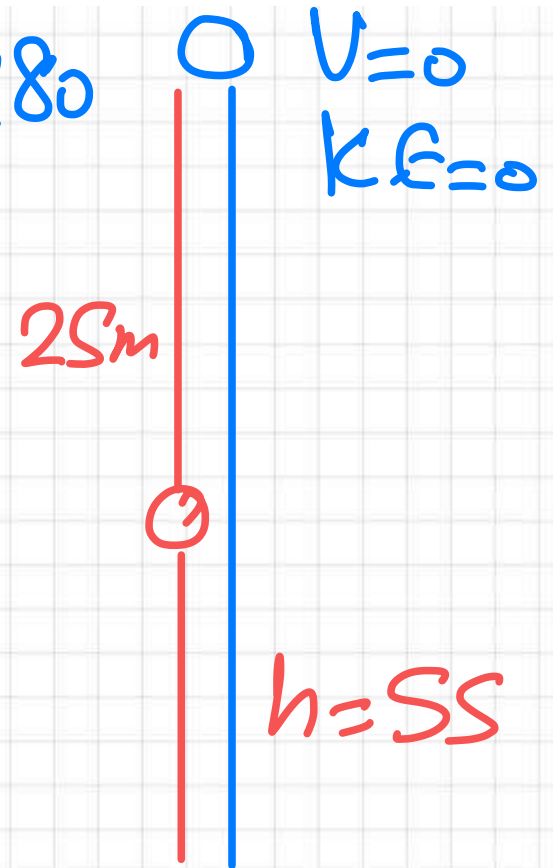
$$M.E = P.E_{\text{max}} = mgh = 2 \times 10 \times 80$$

$$M.E = 1600 \text{ J}$$

$$M.E = mgh + K.E$$

$$1600 = 2 \times 10 \times 55 + K.E$$

$$K.E = 500 \text{ J}$$



4-A ball fell to the ground from a height of 5 m. Using energy concepts, the speed of the ball just before it hits the ground (ignoring air resistance) equals.....

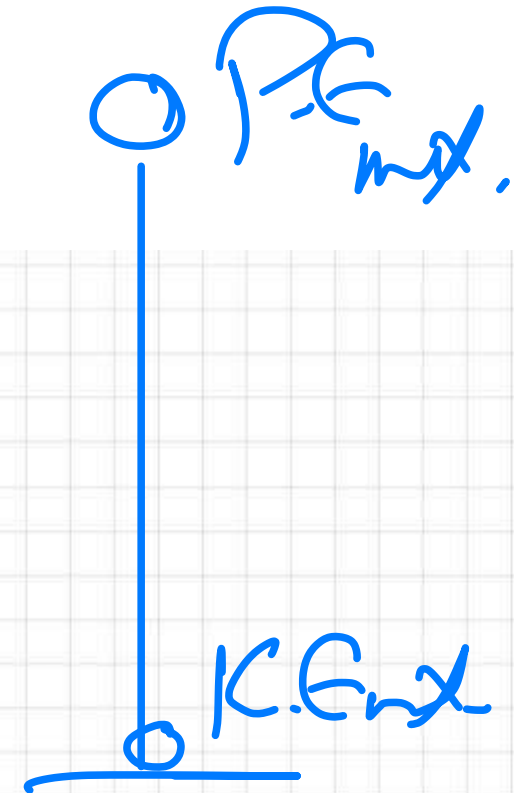
- a) 5 m/s
- b) 50 m/s
- c) 10 m/s
- d) 20 m/s

$$P.E_{\text{initial}} = K.E_{\text{final}}$$

$$mgh = \frac{1}{2}mv^2$$

10 5

$$10 \text{ m/s}$$

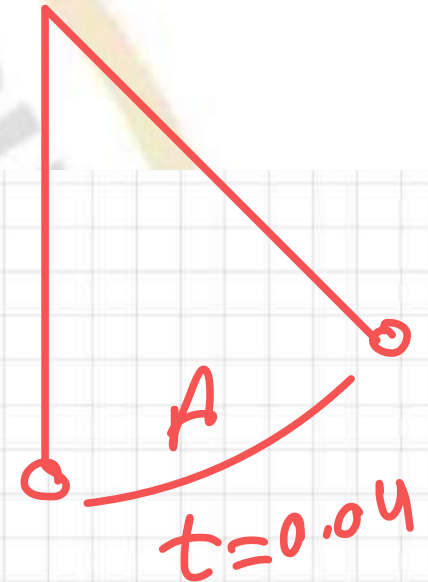


5- An oscillating body takes a time period of 0.04 s to reach its maximum displacement away from its original equilibrium position; therefore, its frequency equals:

- a) 25 Hz
- b) 31.25 Hz
- c) 6.25 Hz
- d) 20 Hz

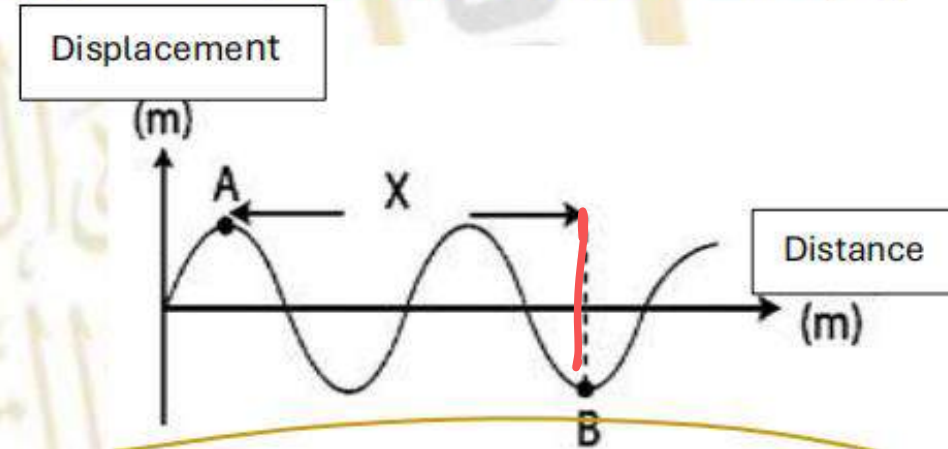
$$n = \frac{1}{4} \quad t = 0.04 \quad T = 0.16 \text{ sec}$$

$$n = 6.25 \text{ Hz}$$



6-For a transverse wave with speed 10 m/s and frequency 2.5 Hz, the horizontal distance (X) between points A and B is:

- a) 4 m
- b) 5 m
- c) 6 m
- d) 7 m



$$V = \lambda \nu$$

$$10 = 2.5 \lambda$$

$$\lambda = 4 \text{ m}$$

$$\nu = 1.5$$

$$\lambda = \frac{X}{n}$$

$$X = \lambda n = 6 \text{ m}$$

7-Frequency is numerically greater than the periodic time by 3.75 when the periodic time equals

a) 2 s

b) 1/2 s

c) 1/4 s

d) 4 s

$$\nu = T + 3.75$$

$$\frac{1}{T} = T + 3.75$$

$$T = \frac{1}{4} \text{ Sec}$$

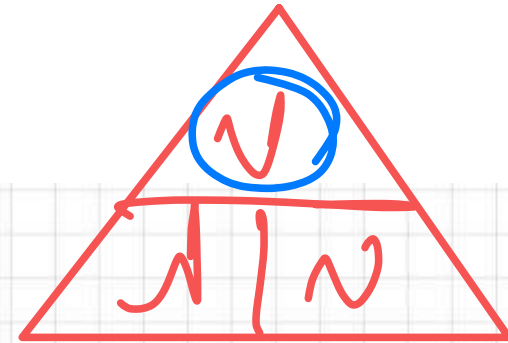
8-If the frequency of a second wave is less than the first by one-fourth, the wavelength of the second:

a) Increases by 25%

~~c) Decreases by 33%~~

b) Increases by 33%

~~d) Decreases by 25%~~



$$\nu_1 = 1$$

$$\nu_2 = 0.75$$

$$\frac{\nu_1}{\nu_2} = \frac{\lambda_2}{\lambda_1} = \frac{1}{0.75}$$

$$\nu_1 > \nu_2$$

$$\lambda_1 < \lambda_2$$

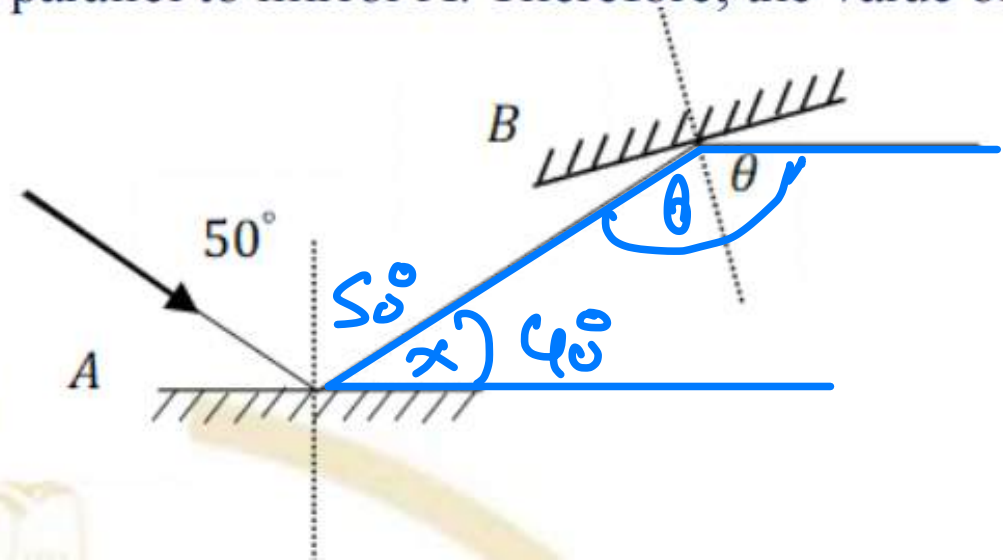
$$\lambda_2 = \frac{4}{3} \lambda_1$$

$$\Delta \lambda = \lambda_2 - \lambda_1$$

$$= \frac{4}{3} \lambda - \lambda = \frac{1}{3} \lambda$$

9-A light ray falls on horizontal mirror A at an angle of 50° as shown. It reflects to fall on mirror B and reflects from it in a direction parallel to mirror A. Therefore, the value of θ is:

- a) 40°
- b) 50°
- c) 60°
- d) 70°

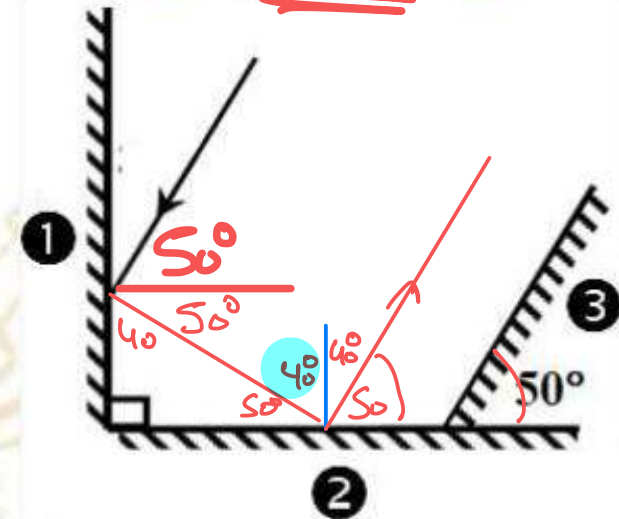


$$2\theta + x = 180$$

$$\theta = 70^\circ$$

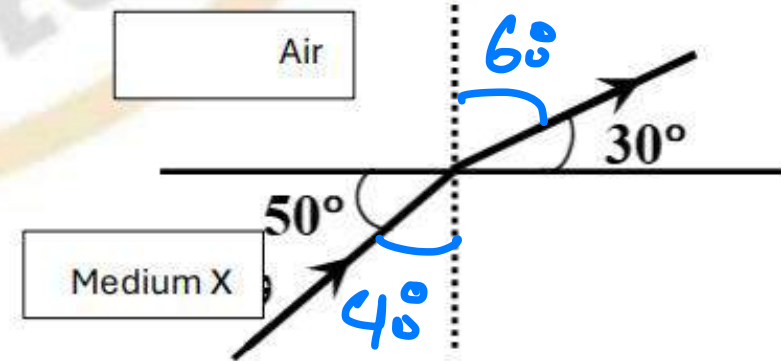
10-In the figure, three mirrors. In which (1) and (2) are perpendicular while mirror (3) makes an angle of 50° with mirror (2). If a ray falls on mirror (1) parallel to mirror (3), it will fall on mirror (2) at an angle of:

- a) 30°
- b) 40°
- c) 50°
- d) 60°



11-In the figure shown, the speed of light in medium X equals ($c = 3 \times 10^8$ m/s):

- a) 2.7×10^8 m/s
- b) 4.04×10^8 m/s
- c) 1.92×10^8 m/s
- d) 2.23×10^8 m/s



$$\frac{\sin \phi}{\sin \theta} = \frac{v_1}{v_2} \rightarrow$$

$\begin{matrix} \nearrow 40 \\ \sin \phi \end{matrix}$
 $\begin{matrix} \nearrow 60 \\ \sin \theta \end{matrix}$
 $\begin{matrix} \rightarrow \\ v_1 \end{matrix}$
 $\begin{matrix} \rightarrow 3 \times 10^8 \\ v_2 \end{matrix}$

$$\downarrow$$

60

$$0.74 = \frac{v_1}{3 \times 10^8} \rightarrow 2.22 \times 10^8$$

12- When the angle of incidence changes from 80° to 40° the angle of refraction will change from 40° to:

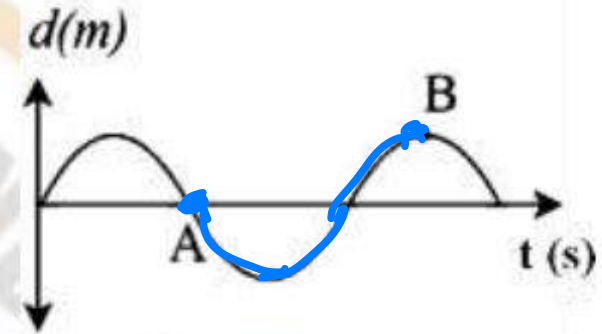
- a) 22.5°
- b) 24.8°
- c) 20°
- d) 30°

$$\frac{n_2}{n_1} = \frac{\sin \phi_1}{\sin \theta_1} = \frac{\sin \phi_2}{\sin \theta_2}$$

$\nearrow 80$ $\nearrow 40$
 $\searrow 40$ $\downarrow$
0.419
 $\theta_2 = 24.77^\circ$

Second: Essay Questions

- 1-The curve represents a wave with a frequency of 25 Hz.
Calculate the time interval between points A and B.

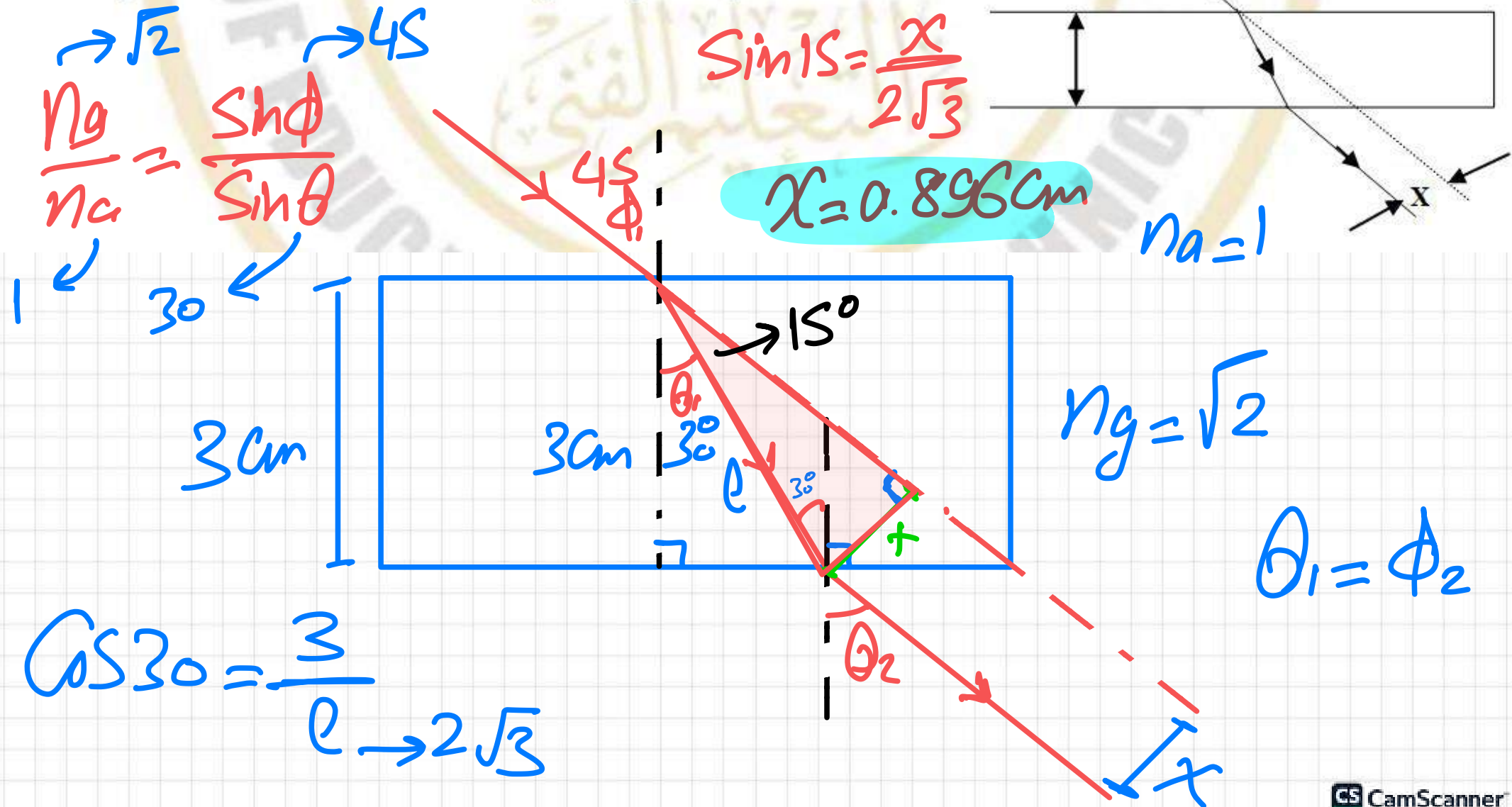


$$v = 25 \quad n = 0.75$$

$$t = \quad 25 \leftarrow v = \frac{n}{t} \rightarrow 0.75$$

$$\rightarrow 0.03 \text{ sec}$$

- 2- In the figure, a light ray falls at an angle of 45° from air onto one side of a parallel-sided glass plate with a refractive index of $\sqrt{2}$ and a thickness of 3 cm. The ray exits shifted from its original path by a distance X . Find X .

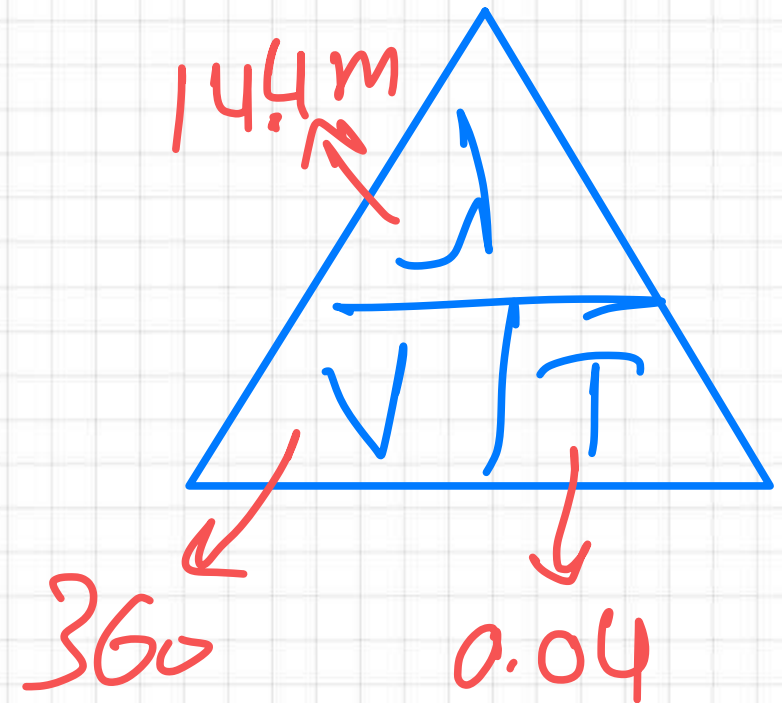


3-An oscillating body completes a full oscillation every 0.04 s. The sound reaches a person 216 m away 0.6 s after it occurs. Calculate the distance between the center of the second compression and the center of the fifth compression.

$$T = 0.04 \quad x = 216 \quad t = 0.6$$

$$v = \frac{x}{t} = \frac{216}{0.6} = 360 \text{ m/s}$$

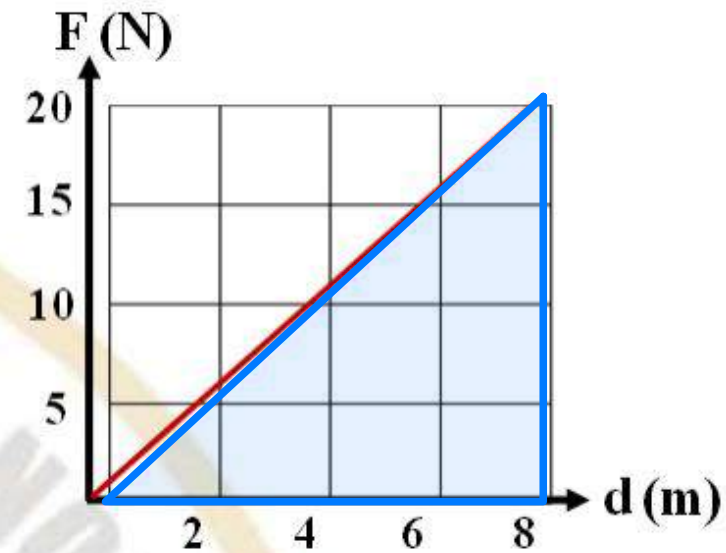
$$\Delta l = 413.2 \text{ m}$$



First: Multiple Choice Questions

1. The following graph represents the relationship between the force acting on an object and the displacement it moves in the direction of the force. The total work done by this force equals:

(a) 2.5 J (b) 40 J (c) 80 J (d) 160 J

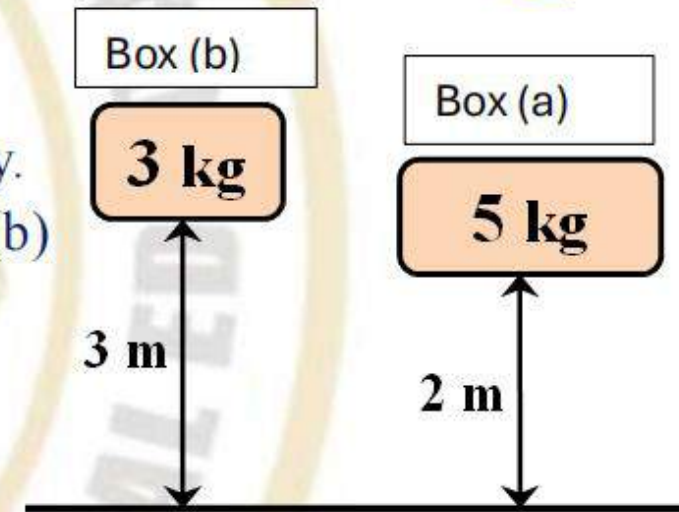


$$W = Fd = \frac{1}{2} \times 8 \times 20$$
$$= 80 \text{ J}$$

2. Two boxes, (a) and (b), have masses of 5 kg and 3 kg respectively. Box (a) is placed at a height of 2 m from the ground, while box (b) is at a height of 3 m.

To make the potential energy of box (a) equal to 2/3 of the potential energy of box (b), box (b) must be moved by:

- (a) 1.5 m downwards
(b) 2 m upwards
(c) 2.5 m downwards
(d) 5 m upwards



$$P.E_a = \frac{2}{3} P.E_b$$

$$m_a g h_a = \frac{2}{3} m_b g h_b$$

$$5 \times 2 = \frac{2}{3} \times 3 h_b \Rightarrow h_b = 5m$$

3. An object moves horizontally at a constant speed under influence of a horizontal force (F) of 10 N. The object travels a distance of 5 m.

Which of the following statements is incorrect?

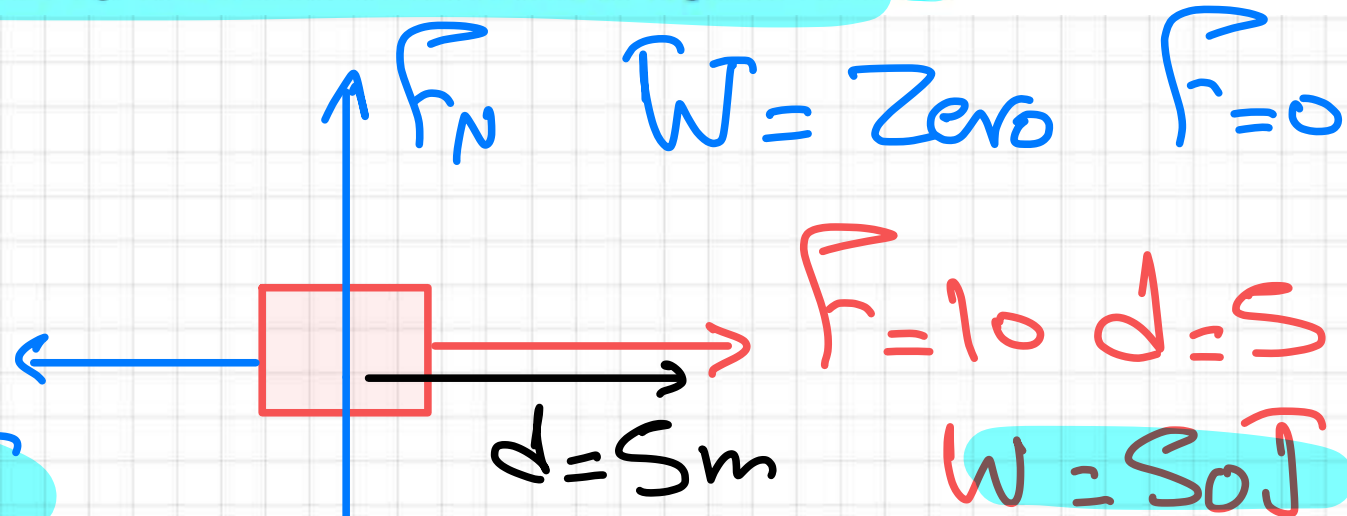
- ~~(a)~~ The work done by force (F) equals 50 J.
- ~~(b)~~ The work done by the friction force equals -50 J.
- ~~(c)~~ The work done by the force of gravity equals zero.
- (d) The total work done by the horizontal forces equals 100 J.

$$\Sigma F = 0$$

$$d = 5 \text{ m}$$

$$-10 \text{ N} = f_f$$

$$W = -50 \text{ J}$$



$$W = mg$$

$$\vec{W} = W d \cos 90^\circ = \text{Zero}$$

4. If the potential energy of a free-falling object is calculated by the relationship $PE = 10h$, then the kinetic energy of the object when its speed reaches 6 m/s equals: ($g = \underline{10 \text{ m/s}^2}$)
- (a) 3 J (b) 6 J (c) 18 J (d) 36 J

$$M.E = P.E = 10h = mgh$$

$\downarrow$ 1 kg $\downarrow$ 10

○ $V=0$
 $K.E=0$

↓

$$K.E = \frac{1}{2}mv^2$$
$$= \frac{1}{2} \times 1 \times 6^2 = 18 \text{ J}$$

5. If the ratio between the frequency of an oscillating body and its periodic time is $49/4 \text{ s}^{-2}$, then the time required to complete 21 oscillations is

(a) 6 s

(b) 7 s

(c) 11 s

(d) 21 s

$$\frac{\nu}{T} = \frac{49}{4}$$

$$\frac{1}{T^2} = \frac{49}{4}$$

$$T = \frac{2}{7}$$

$$\frac{\nu}{21} = \frac{49}{4}$$

$$\nu^2 = \frac{49}{4}$$

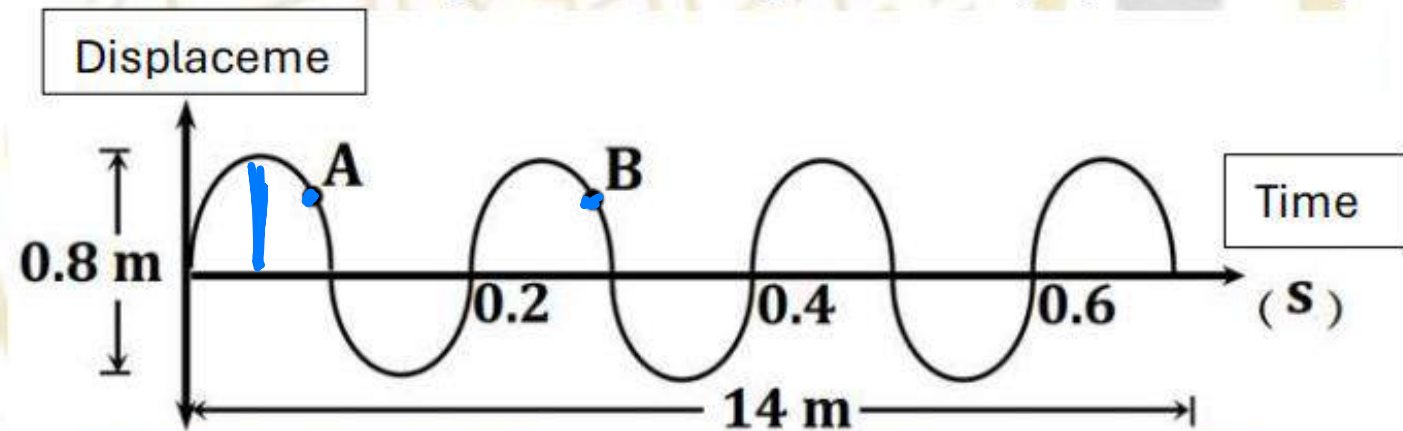
$$\nu = \frac{7}{2}$$

$$\frac{\nu}{T} = \frac{49}{4}$$

$$\frac{n^2}{t^2} = \frac{49}{4}$$

$$t = 6 \text{ sec}$$

6. The following graph shows the relationship between displacement (m) and time (sec.) for a transverse wave.



So, the ratio between the distance between points A and B and the wave amplitude is:

- (a) 5
(b) 10
(c) 17.5
(d) 35

$$\frac{\lambda}{0.4} = 10$$

$$\lambda = 14$$

$$n = 3.5 \quad \lambda = 4$$

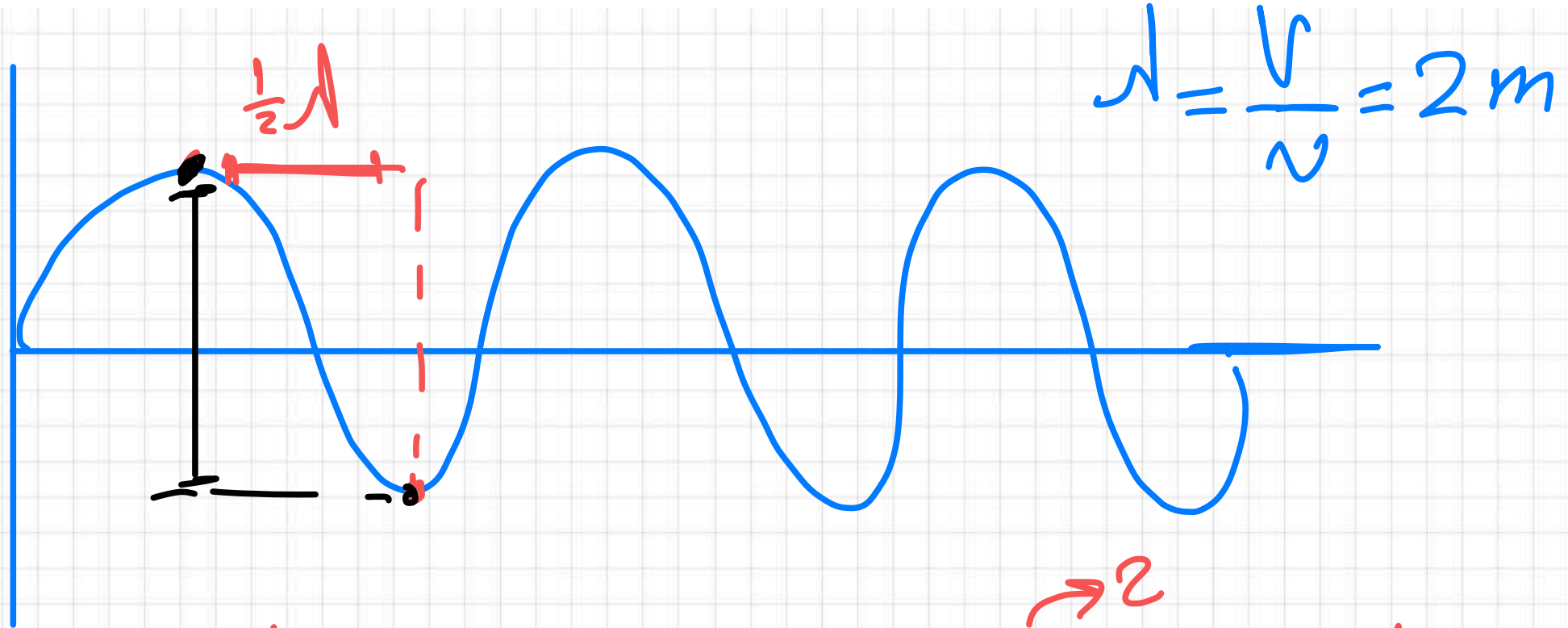
7. In a transverse wave, the horizontal distance between a consecutive crest and trough is double the vertical distance between them. If the wave speed is 20 m/s and its frequency is 10 Hz, then the wave amplitude is:

(a) 0.25 m

(b) 0.5 m

(c) 1 m

(d) 2 m



$$\frac{1}{2}\lambda = 2 \times 2A \Rightarrow \frac{1}{2}\lambda = 4A$$

$$A = \frac{1}{4}$$

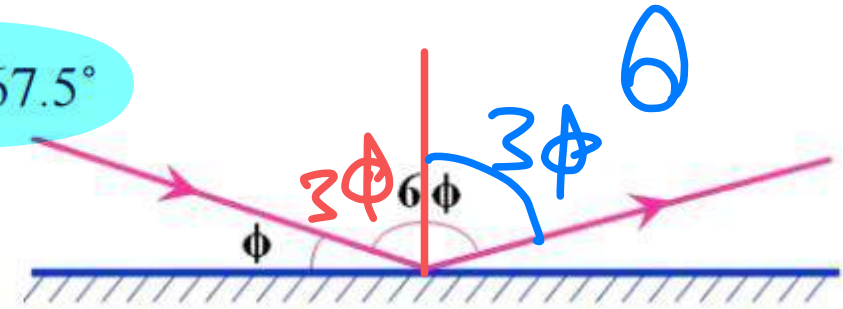
8-In the opposite figure, the angle of reflection equals.....

(a) 22.5°

(b) 30°

(c) 45°

(d) 67.5°



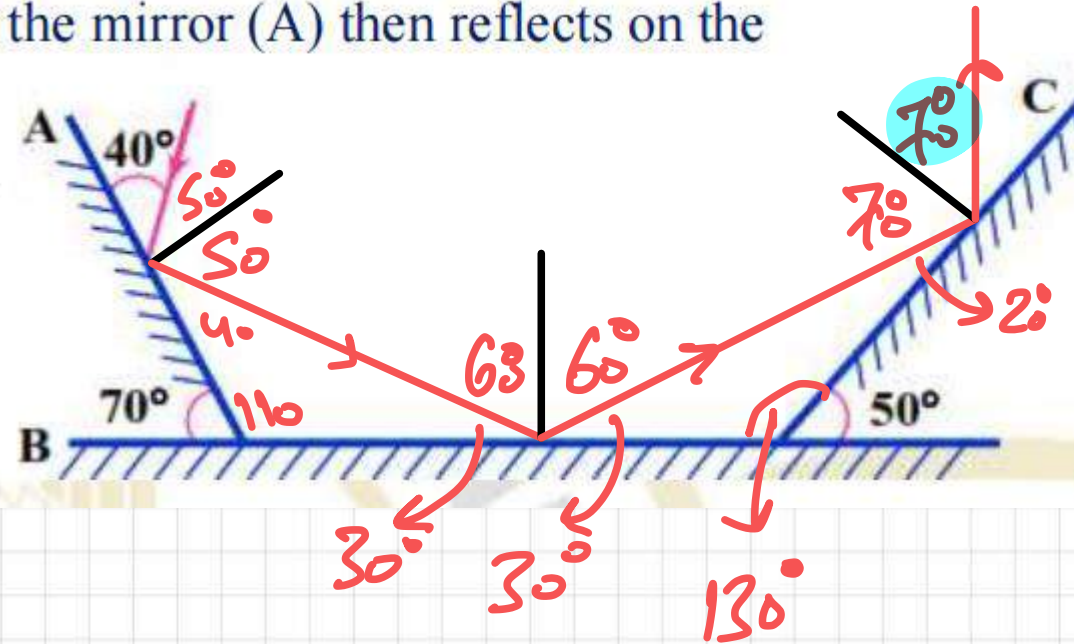
$$4\phi = 90$$

$$\phi = 22.5$$

$$3\phi = \theta = 67.5^\circ$$

9- In the opposite figure. An incident ray falls on the mirror (A) then reflects on the mirror (B), then the mirror (C), so the angle of reflection from the mirror (C) equals

- a) 20°
- b) 40°
- c) 50°
- d) 70°

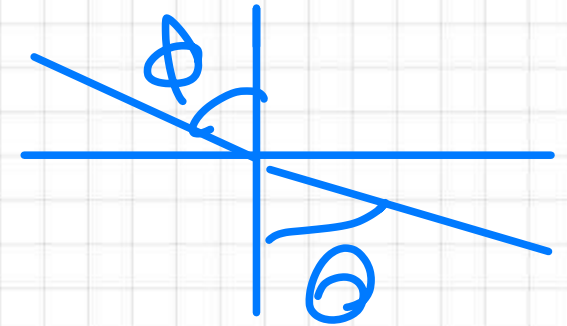


10. A light ray passes at an angle from a medium with a refractive index of $n_1 = \frac{7}{6}$ to the interface of a medium with a refractive index of $n_2 = \frac{8}{7}$. Therefore:

- ~~(a)~~ Its speed increases and it refracts toward the normal.
- ~~(b)~~ Its speed decreases and it refracts away from the normal.
- ~~(c)~~ Its speed decreases and it refracts toward the normal.
- (d) Its speed increases and it refracts away from the normal.

$$\frac{8}{7} \nearrow \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\sin \phi}{\sin \theta} = 0.97$$

$$\frac{7}{6} \nwarrow$$



$$v_1 < v_2$$

$$\phi < \theta$$

$$n \propto \frac{1}{v} \propto \frac{1}{\theta}$$

away

11-A light ray falls on a glass surface with an angle of incidence of 40° and refracts at an angle of 30° . If the angle of incidence increases to double its value, the angle of refraction increases by

(a) 15°

(b) 20°

(c) 30°

(d) 60°

$$\frac{n_2}{n_1} = \frac{\sin \theta_1}{\sin \theta_2} = \frac{\sin \theta_1}{\sin \theta_2}$$

Handwritten annotations: 40 above θ_1 , 80 above θ_2 , 30 below θ_1 , and 50 below θ_2 .

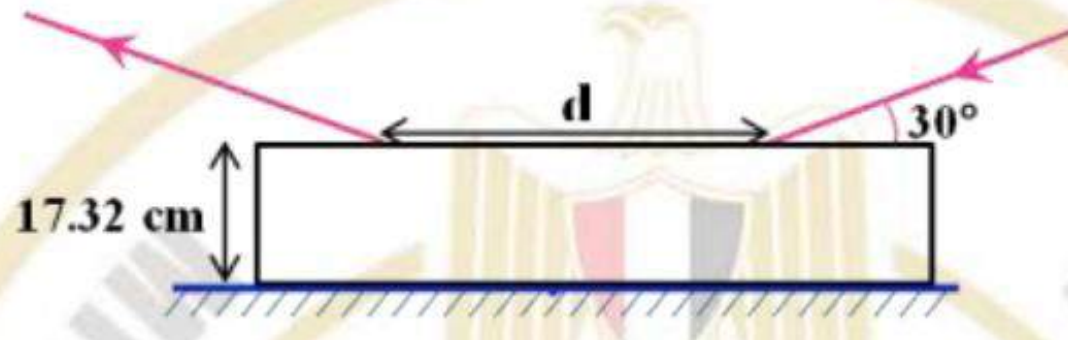
12-The opposite figure shows a rectangular glass block with a thickness of 17.32 cm and a refractive index of $n = \sqrt{3}$, placed on a horizontal plane mirror. A light ray is incident on the upper surface making an angle of 30° with the surface. The ray is refracted, then reflected by the mirror, and finally emerges again from the upper surface at a distance (d) from the point of incidence. The value of d is equal to

A) 4.33 cm

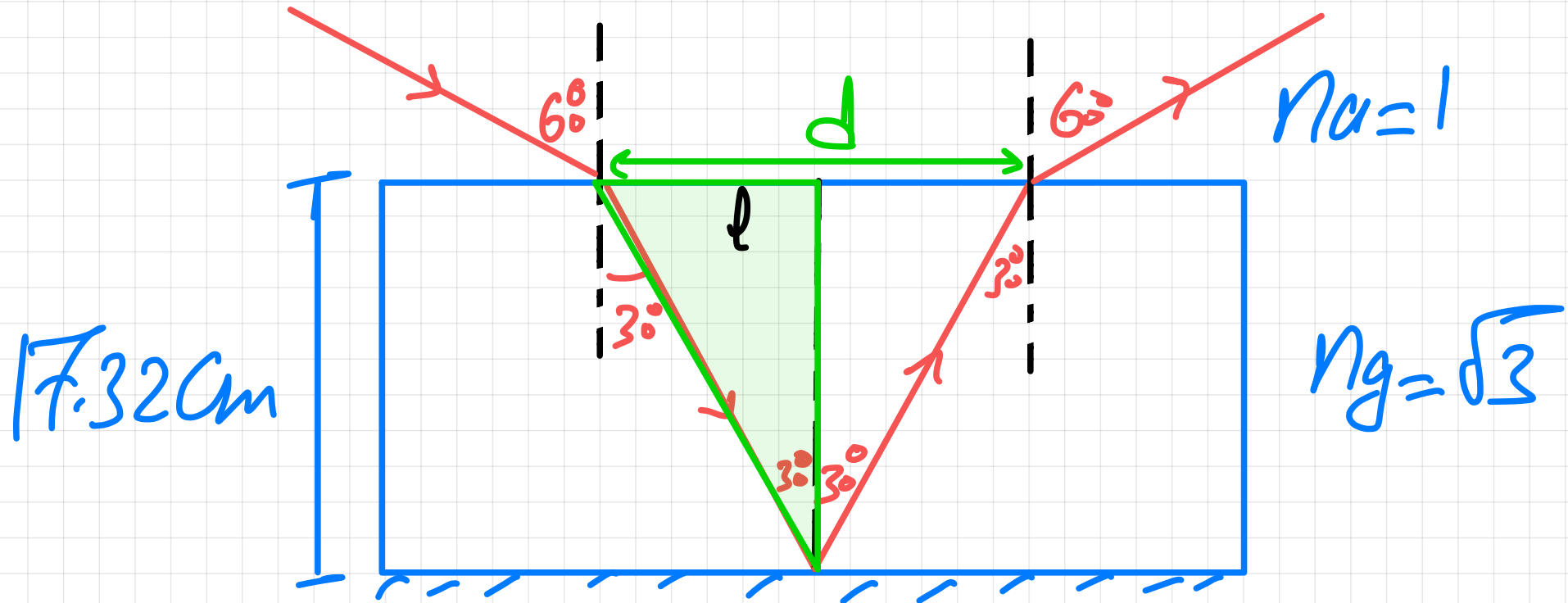
B) 10 cm

C) 8.66 cm

D) 20 cm



$$d = 20\text{cm}$$



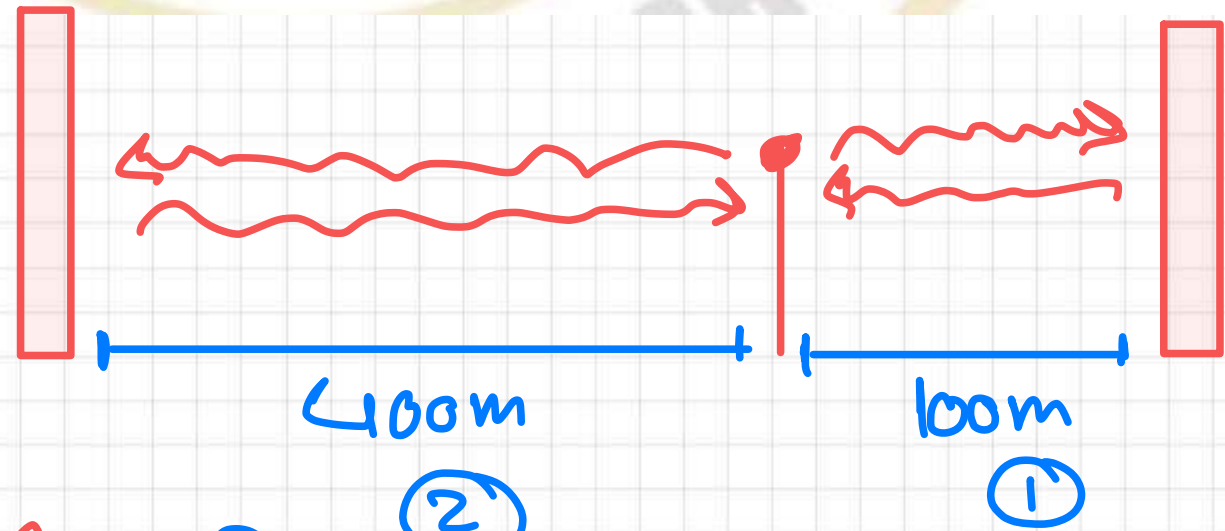
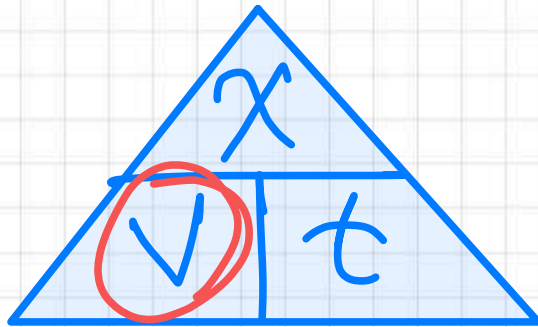
$$\sqrt{3} \leftarrow n_2 = \frac{\sin \phi \rightarrow 60}{\sin \theta \rightarrow 30} \leftarrow n_1$$

$$\tan 30 = \frac{l}{17.32}$$

$$l = 10\text{cm}$$

Second: Essay Questions

13. A man stands between two towers. He is 100 m away from one and 400 m away from the other. When he strikes a drum, he hears two sounds with a time interval of 2 s between them. Calculate the speed of sound in the air.



$$200 \leftarrow \frac{x_1}{t_1} = \frac{x_2}{t_2} \rightarrow 800 \quad \textcircled{2}$$

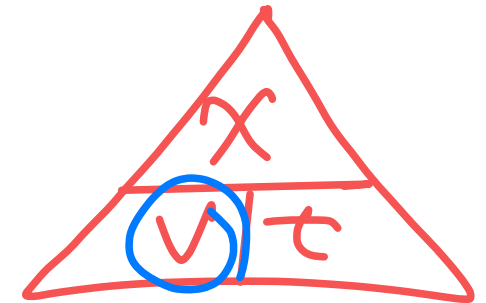
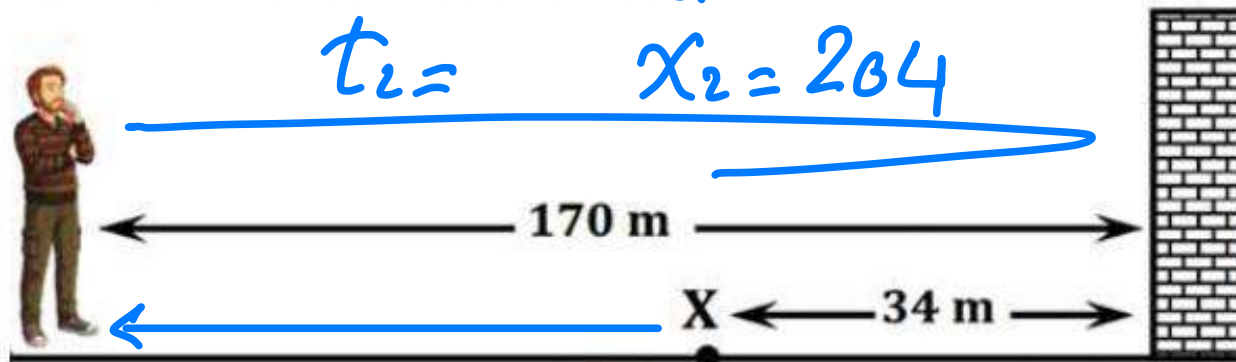
$$t_2 \rightarrow t_1 + 2$$

$$t_2 = t_1 + 2$$

$$t_1 = \frac{2}{3} \text{ sec}$$

$$V = \frac{x_1}{t_1} = 300 \text{ m/s}$$

14-A person stands in a wide field facing a wall at a distance of 170 m. A gun was placed at point (X), which is 34 m away from the wall. A bullet was fired from the gun. Calculate the time interval between the two sounds heard by the person, knowing that the speed of sound in the air is 340 m/s.



$$V = \frac{\Delta x}{\Delta t} = \frac{68}{\Delta t} = 340$$

$$\Delta t = 0.2 \text{ sec}$$

15-Two sound waves are propagating in the air. The first has a frequency of 680 Hz, and the second has a frequency of (ν). If the wavelength of one of them exceeds the wavelength of the other by 50 cm, calculate the value of the frequency (ν)?

Note that the speed of sound in the air = 340 m/s.

⑤

$$\nu_1 = 680$$

$$V = 340$$

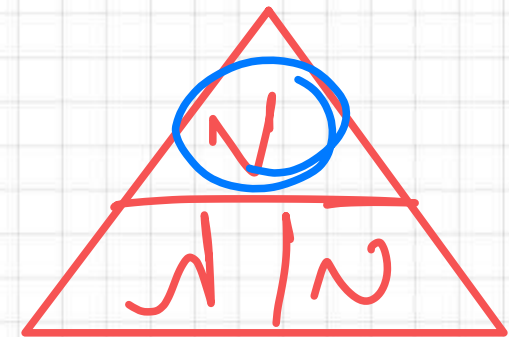
$$\lambda_1 = \frac{1}{2} \text{ m}$$

$$\nu_2 = \nu$$

$$V = 340$$

$$\lambda_2 = 1 \text{ m}$$

$$\lambda_2 = \lambda_1 + \frac{1}{2}$$



$$\nu = \frac{V}{\lambda} = \frac{340}{1} = 340 \text{ Hz}$$

كيفية طباعة صفحات معينة من ملف معين مثلا ازاي نطبع الصفحات من صفحة 4 الى صفحة 9

